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NEW LIFE-SAVING INVENTIONS.

In the accompanying engravings are represented a series of devices, including means of escape from a building in case of fire, and also a life preserver for shipwrecked persons. The first mentioned invention is illustrated in Figs. 1, 2, 5, 6 and 7. It consists of a stout rope, soaked in a chemical solution which renders it fireproof, and having a strong hook at one end. On this rope slides the lowering device, which is shown in Fig. 1. This consists of a box of metal, in which is a stationary disk, A, around which the rope is carried. The two parts of the box are hinged together at B, and, when closed, compress the rope in the grooves through which it passes downward. The degree of compression is regulated by the thumbscrew, C, which brings the parts of the box more or less tightly together. Also attached to the box is a double rope, to the end of which is secured a small hook, D, for the purpose of fastening it into the belt.

In using the device, the bed clothes are placed on the window sill to prevent chafing of the rope; the large hook on the main rope is then placed over the top crossbar of the window sash. The operator then secures around his waist a strong belt, made as shown in Fig. 7; and with the staple thereon he engages the hook, D. The screw, C, having been previously adjusted to the desired rate of speed of descent, he then launches himself off. He is sustained by the belt, so that his hands are free to govern the lowering device. In this manner as rapid a descent as is desired can be made, or the motion can be checked at any instant by tightening the screw, C. The apparatus can be used for lowering women, children, invalids, or trunks, as one cool-headed person may quickly adjust the screw for each individual to be lowered, and the latter has nothing to do but allow himself to slide quietly down. On reaching the ground, he removes the hook, the rope is hauled up, the box readjusted, and the device is then ready to be used again. Or by simply attaching the rope to the safety belt, the person to be lowered can be let down by another paying out the rope hand over hand.

Fig. 6 represents a compact arrangement of water bucket and fire escape, such as might be placed in every room in a hotel. The upper portion of the vessel shown serves as a water pail, and is kept filled. The lower part serves as a receptacle for the fire escape above mentioned. Fig. 5 is a blanket with two slits for the arms and one for the face. In this, after thoroughly wetting it, a person attempting to escape through the halls of a burning building envelops himself.

Figs. 3 and 4 exhibit a device which the inventor calls a traveler's safety kit. It is a handbag, shaped like a knapsack, of fire or waterproof material, containing bottles or jars which hold a supply of wine or other stimulants, and also meat in condensed form. These are protected from breakage by a packing of best phial corks, with outer walls of cork wood. Suitable receptacles are provided for valuables; and a sectional flagstaff is added, which may be quickly put together, and to which a signal flag is attached. This staff also may be used in connection with a portable umbrella and also as a walking stick. The kit may be constructed in two portions, with bottles, etc., in each, the division being made vertically through the center. Suitable straps connect the two portions, so that, when adjusted to the person, one portion is applied to the back and the other to the breast. The apparatus is sufficiently buoyant to sustain a heavy person in the water, as shown in Fig. 4. In case of accident to a vessel at sea, the inventor states that the person provided with this kit has not only a life preserver which will keep him afloat indefinitely, but also a supply of food which will last for several days.

For further information, address the inventor, Mr. H. R. Houghton, 59 West 42d street, New York city.

German vs. Sheffield Scissors.

"At the annual meeting of the Sheffield Scissors Manufacturers' Association, held during the past month, an animated discussion took place on the remarkable success with which the German scissors makers are competing with those of Sheffield. Mr. Hobson, the chairman, said that a warehouse had been opened in Sheffield for the express purpose of stocking and selling German scissors, and various other speakers were constrained to admit that the foreign articles were by no means badly made. As a matter of strict and most surprising fact, these German scissors are made at Solingen from Sheffield steel, and, after bearing freights in both directions, thus oust us at home. When the German scissors come here they are offered at prices 30 to 40 per cent. below the home-made goods—weavers' scissors sold by the Sheffield manufacturers at 72 cents, gold, being quoted by the importers at 54 cents free in London, or 72 cents in Sheffield. The consequence is that the Germans are doing a very large business in the steel metropolis, because almost all the manufacturers find it necessary to keep the foreign goods in stock." —*British Trade Journal.*

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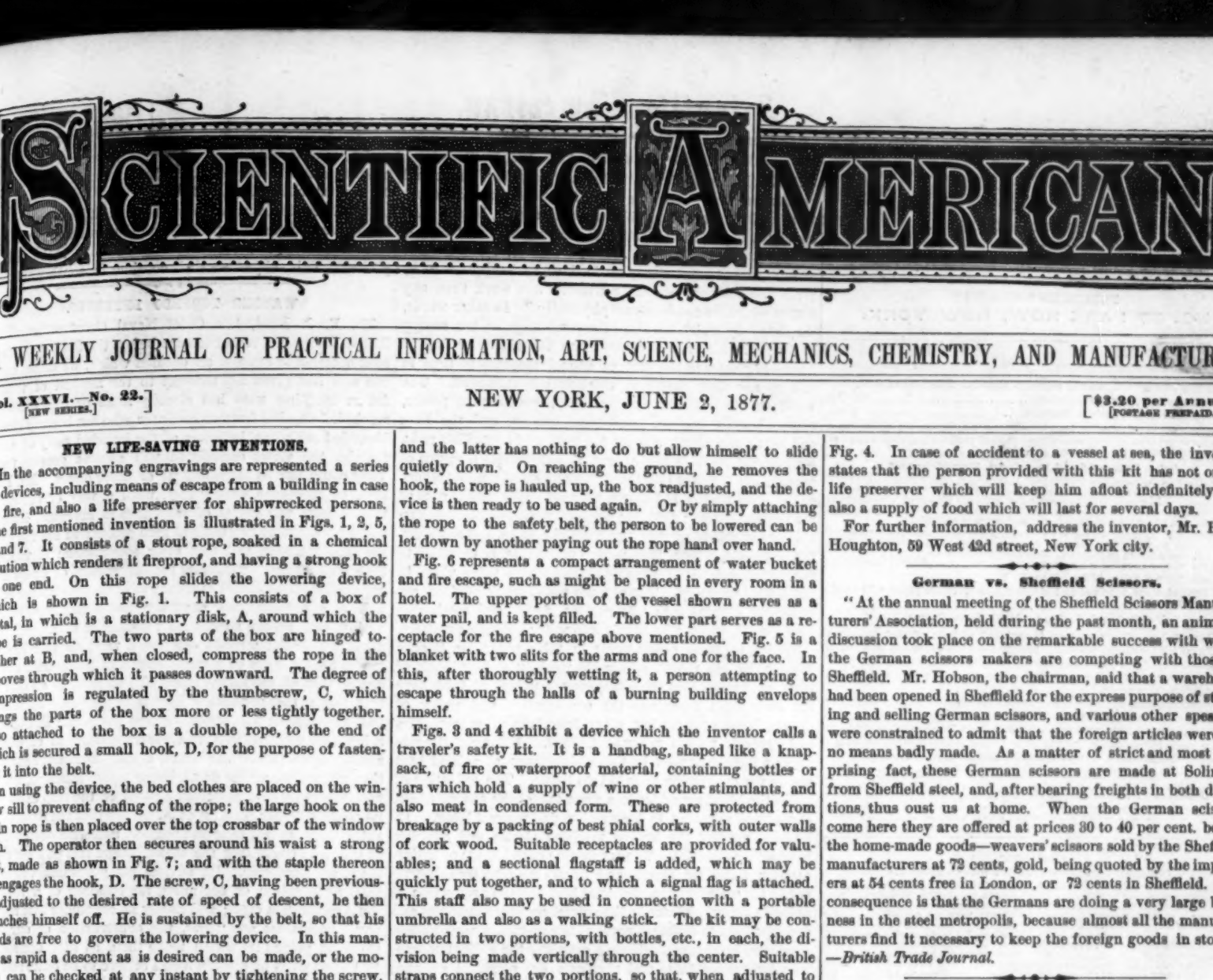

HOUGHTON'S LIFE-SAVING DEVICES.

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THE SCIENTIFIC AMERICAN SUPPLEMENT,
No. 74,
For the Week ending June 2, 1877.

THE HUMAN MACHINE AND ITS FUEL.

Dr. Joule has pointed out that not only does an animal much more nearly resemble in its functions an electromagnetic engine than it resembles a steam engine, but he also has stated that it is a much more efficient engine—"that is to say," says Professor Tait, "an animal, for the same amount of potential energy of food or fuel supplied to it, gives you a larger amount converted into work than any engine which we can construct physically." In other words, the duty—by which we mean the percentage of the energy of the fuel which it can convert into the useful or desired form—is greater in the case of animal mechanism than in that of any other engine in which fuel is employed. The work we obtain in the form of heat, constructive power, nervo-muscular action, mechanical motion, and the like: and here the analogy between the body and a machine ends, because the food in the animal is not merely a source of energy, but it enters into the development and maintenance of the body itself. It follows, therefore, that two classes of food are necessary; first, the organic, which alone is oxidizable or capable of generating potential energy, and secondly, the inorganic, which, though not oxidizable, is essential to the metamorphosis of organic matter which takes place in the animal economy. The organic constituents of food are generally divided into nitrogenous, fatty, and saccharine compounds, and the inorganic into water and saline matters.

Taking up these constituents in their order, Dr. George Wilson, in his recent admirable work, "A Handbook of Hygiene," states that the nitrogenous portions of food have for their main functions the construction and repair of tissues, besides possessing other functions of a regulative and dynamic nature not well defined. Fatty constituents play an important part in the maintenance of animal heat and in the conversion of food into tissue. The oxidation of fat in the blood generates to a great extent the energy which is rendered apparent in locomotion and manual labor. It, besides, renders the human machine elastic, and supplies lubricating material. The saccharine constituents of hydrocarbons (cellulose, starch, and sugar) are directly subservient to the maintenance of animal heat and the production of animal energy. Water in the animal economy dissolves and conveys food to different parts of the system, removes effete products, lubricates the tissues, equalizes the bodily temperature by evaporation, and regulates the chemical changes which take place in the processes of nutrition and decay. Saline matters, on the other hand, are the chief media for the transference of the organic constituents throughout the body. They are largely concerned in the consolidation of the tissues, and are supposed to convert unabsorbable colloids into highly diffusive crystalloids.

As we have already stated, the potential energy of food is the sole source of the active energy displayed in mechanical motion or work. And consequently, up to certain limits, the diet must be increased as the work increases. The question for the economist is then, first, on how much food can a man subsist and live: and second, how much more food must be added when certain work is to be performed. Dr. Edward Smith has determined that the Lancashire operatives during the cotton famine managed to live on 3,888 grains of carbon and 181 grains of nitrogen per day. This is equivalent to about 2 lbs. of baker's bread. On the other hand, a man, who could live on this amount during idleness, while at work requires (according to Dr. Letheby) 6,823 grains of carbon and 391 grains of nitrogen. This is equivalent to 2 lbs. of beef, with 1 lb. of potatoes, 1 lb. of beer, and about ¼ lb. of sugar.

Of course the quantity of the food required differs not merely with the amount of work done, but with its quality. Dr. Smith has prepared a table showing the weekly dietaries of low-fed operatives. Needlewomen, for example, in London average 124 ozs. breadstuffs, 40 ozs. potatoes, 7·3 ozs. fats, 16·3 ozs. meat, 7·0 ozs. milk, 0·5 oz. cheese, and 1·3 ozs. tea per week. This diet is richer in meat than that of the English farm laborer. The Macclesfield silk weavers are quoted at 3·2 ozs. meat per week. The Irish farm laborer gets but 4·5 ozs. meat weekly, but he has 326 ozs. breadstuffs and 135 ozs. milk. The Scotch farm worker eats over twice as much potatoes as the Irishman, despite the supposed fact that the tubers constitute the principal article of diet among the peasantry of the Emerald Isle. The table compiled by Dr. Smith includes silk weavers, shoemakers, farm laborers, and needlewomen, and the average diet per day for all is 4,881 grains of carbon and 214 grains of nitrogen. We can contrast with this, data obtained by Dr. Playfair covering the diets of English railway navvies, English and French sailors, soldiers in peace, prizefighters, hard-worked weavers, and blacksmiths. This shows that the average is 5,837 grains of carbon and 400 grains of nitrogen per individual per day. There are many suggestive comparisons to be made here. Take for example the figures relative to weavers. There is one class of these operatives who do light work on a daily average of 3,861 grains of carbon and 157 grains of nitrogen; when at hard work, this becomes 6,020 grains of carbon and 375 grains of nitrogen. As shown above, the first-mentioned quantities are no more than barely sufficient to sustain the body; and work here practically means a wearing away of the human machine. Now when the work becomes harder, 2,159 grains of carbon and 218 grains of nitrogen more are consumed; and these are the food equivalent for the extra work performed. In the case of the prizefighter in training, the daily average in point of carbonaceous matter is less than that of the low-fed operative, but the nitrogenous matter—flesh and muscle manufacturing material—the average is 690 grains, or over three times greater. The proportions of the training athlete's daily food are flesh formers 9·8 ozs., fats 3·1 ozs., starch and sugar 3·27 ozs.

It will be seen from the foregoing that it is quite possible to construct dietaries, especially suited to sustaining the animal mechanism, in accordance with the work to be accomplished. This subject we shall consider in another article.

WANTED—TORPEDO DEFENCES.

Mr. E. J. Reed, late Chief Naval Constructor of the British Navy, in a recent lecture before the Society of Arts, took occasion to express an opinion which, we think, every one who has given any thought to the method of waging future maritime wars has already more or less definitely reached. Coming from an engineer who has been so closely identified with the building of the ironclad navy of Great Britain, the views enunciated will assume greater force. They could not be more radical or more direct. Mr. Reed says, in substance, simply that, until a way of protecting vessels from the effects of torpedoes is invented, ironclad ships, notwithstanding their 24 inch armor and 100 ton guns, are anachronisms, and that their construction is waste of time and money. "Neither the suspension of chain nets, nor additional bulkhead divisions in ordinary forms of ships, will be a sufficient, nor anything like a sufficient, defence against this deadly submarine instrument of attack. The naval Whitehead torpedo delivers a most terrible blow; it moves for the space of some hundreds of yards with a speed double that of the fastest ironclads; its path is so sure and true that at that distance a second torpedo can be made to pass through the hole which the first has made; and whereas it has been assumed that, in ordinary conditions of weather and naval warfare under steam, a ship could not have more than a few feet of her depth below water attacked, the torpedo has the whole immersed bottom of the ship exposed to its assaults." Mr. Reed goes on to say that the days of war ships, more or less long and narrow, and with deep bottoms of thin iron containing the steam boilers and powder magazines, are numbered. He advises his government to reconsider its intention of beginning the building of a vessel of the Agamemnon class; and finally he concludes that modern naval necessities are "first, the construction of our large ships on principles which make them as little destructible by torpedoes as by guns, which I believe to be quite possible; and secondly, the building of all our other war ships of small and handy types." By the latter he means small vessels which can be manœuvred with sufficient rapidity to avoid torpedoes.

Mr. Reed unfortunately fails to mention the plan for protecting ships against torpedoes, the knowledge of which he implies that he possesses. It will be seen, however, that in his opinion a total reconstruction of the English navy is necessary, and that consequently the enormous sums of money which have been expended on its development are entirely thrown away. This is not cheering intelligence to the British taxpayer; and we doubt whether its purport will be acquiesced in until inventors, the world over, confess themselves vanquished by the problem of devising an efficient system of torpedo guard. So long as enormously heavy artillery is to be used, vessels must be built both capable of carrying the guns and likewise capable of resisting them. Already it is contemplated to build cannon which will dwarf the 100 ton gun; and the English iron founders, on the other hand, promise 40 inch rolled plates. If war ships must carry such loads of metal as these, it is difficult to see how they can be built light enough to dodge torpedoes. There is certainly little to be gained by building vessels possessing the latter advantage, if at the same time they are to be rendered easily vulnerable by heavy guns.

We agree with Mr. Reed in the belief that it is possible to protect large vessels against torpedoes, although we have no especial project to propose. The subject is one which we would particularly commend to the attention of inventors. It is obvious that the necessary protections can be obtained in two ways: first, by devices outside or extraneous to the vessel, and second, by modification of the construction of the ship itself. The simplest outside device is the torpedo netting constantly used by our vessels during the war. This is simply a network of chain or rope supported on booms at some distance around the ship and extending down into the water deep enough to guard the entire bottom. To prevent the access of torpedo launches, the ship may be surrounded by heavy spars also attached to the booms, and from these chain nets, as already described, may depend. These devices are obviously of little use or altogether impracticable when the vessel is in motion. To avoid stationary torpedoes anchored in channels, ships have used forked catchers protruding from the cutwater, to grasp and cause the explosion of the obstruction. Rafts pushed in front of ordinary vessels likewise serve a similar end. Under the second plan, war ships are built in watertight compartments. The Inflexible, for example, has 127 such sections. Or, as in the case of Admiral Porter's boat, the Alarm, there is a double hull with the space between divided up, while the entire hold of the ship may, through the watertight bulkheads which cross it, likewise be converted into separate sections. A torpedo, it is supposed, might injure a few compartments, while those still staunch would perhaps float the vessel. With iron ships there is not much surplus of buoyancy, however, and the racking effect of a blast might cause results much worse than the direct injury to the compartments immediately adjacent. Probably the means of defence, nearest to security, lie first in keeping the vessel constantly

under steam and under control, and second in the electric light which reveals the approach of an enemy by night. But the circumstances of weather or of locality may prevent the rapid manœuvring of the ship, and a fog may render the electric beam useless: while there is no safeguard against the unseen approach of the submarine torpedo of the Ericsson, Lay, or Whitehead type.

The conditions of the problem need no especial explanation. It is simply a question of how to render a ship's bottom invulnerable, not merely to the explosion of the torpedo itself but to that shock *plus* the energy of the ramming blow delivered by the sharp bow of a heavy torpedo boat. An invention of this kind would be immensely valuable to every naval power, and would insure fame and fortune for its originator.

TORPEDOES.

BY G. GAKUMA.

The development of submarine warfare has been so rapid of late that it is hardly possible to foretell what potent influence it may have on the war now being waged in Eastern Europe. While England, France, Italy, and in fact nearly all the European naval powers, have been building huge engines of war, of a tonnage, armor, and artillery never heard of before, the torpedo has been gradually perfected, and threatens, at least under many circumstances, to neutralize them. A torpedo may be regarded as a gun which dispenses with a gun carriage, and which, without the vast and expensive agency of a great ship, inflicts as formidable a blow as that of the heaviest artillery.

The original inventor was David Bushnell, born at Westbrook, Connecticut, 1742. He not only devised a torpedo, but also a submarine rowing boat, intended to convey it to the bottom of the vessel to be attacked. His practical experiments, however, which he was enabled to carry out with the assistance of the private purse of George Washington, did not prove successful; and the invention sank into oblivion until the commencement of the present century, when Robert Fulton, an American sojourning in France, offered a similar one to the French Government. After considerable parleying, it was rejected, and Fulton sold his secret to the British Admiralty for $75,000. The so-called Catamaran Expedition, an attempt to destroy the French line-of-battle ships and transports off Boulogne, turning out a failure, Fulton returned to the United States, and, during the war of 1812, tried in vain to blow up several of the English blockaders. The rage of the British commanders knew no bounds and the proceedings were termed "unchristian," "the invention of a fiend," etc. Cousin John Bull has a frightfully short memory at times!

In 1829, Colonel Samuel Colt commenced experiments with a submarine torpedo exploded by a galvano-electric battery; and after many disappointments, he succeeded on October 18, 1842, in destroying the brig Volta in New York harbor, in the presence of 40,000 excited spectators. So far only vessels at anchor had been attacked; but on April 13, 1843, Colt blew up a brig of 500 tons under sail on the Potomac river, he himself being the operator, and at the time at Alexandria, five miles distant from the explosion.

The first European government to adopt the invention was Austria, who laid down a perfect electric torpedo net for the defence of Venice. Russia followed suit, and during the Crimean war protected the entrance of Cronstadt as well as that of Sebastopol harbor by an improved system of ground torpedoes, which kept the English fleet at a respectful distance. The American civil war for the first time clearly demonstrated the tremendous effect of the invention, and at the same time changed its character from a purely defensive to an offensive weapon. Galled by the soon-established superiority of the United States navy, which gradually sealed up all the important Southern ports, the Confederate Government organized a special torpedo service corps; and after sinking torpedoes in every available approach, they proceeded to build small steamers constructed to carry spar torpedoes. These torpedo boats, with an easily comprehensible Biblical allusion, were called "Davids," and were in several instances used with as much pluck and perseverance as terrible effect. The United States soon imitated the David, and in 1864 the late Commander Cushing, U.S.N., succeeded in destroying the Confederate ram Albemarle, lying at anchor in the James river. Since then the electric apparatus for torpedoes and the torpedo itself have been vastly improved; and numerous new inventions have been introduced, all of which, however, may be classed under the following five heads: Ground torpedoes, spar torpedoes, Harvey (towing) torpedoes, Whitehead (fish) torpedoes, and the Lay torpedo.

GROUND TORPEDOES.

The ground torpedo is a sort of sunken mine, exploding either by contact or by electricity. If these are judiciously laid down around a harbor or anchorage, the approach of hostile ships may be rendered impracticable, provided always they are protected by shore batteries or armed ships to prevent removal. Every channel may be barred by these hidden mines; and they may be made so powerful that any ship under which they explode is sure to become hopelessly disabled. They are fastened to and held in their positions either by anchors or by stockades. The bursting charge consists of gunpowder, gun cotton, or dynamite; and the case or shell is either made of iron or wood; in Charleston harbor, old steam boilers were frequently used.

SPAR TORPEDOES.

The spar torpedo is fastened to the end of a spar from 15 to 38 feet long, carried in a boat, no matter how small, and explodes also either by electricity or contact. A most remarkable experiment was recently made at Cherbourg, France, with spar torpedoes, carried by a little vessel called the Thorneycroft, which was almost submarine. We illustrated this invention on pp. 239 and 246 of our current volume. A very small part of it was above water, but it was of sufficient strength to carry engines and two lateen sails, and it was worked by a lieutenant, two engineers, and a pilot. The French Admiral had two disabled ships in succession towed out to sea at a speed of 14 knots an hour. The Thorneycroft, however, was able to go at the rate of 19 knots an hour, a rate not attained by any vessel in the squadron. She very soon caught up with her prey, delivered her blow with a spar torpedo, which projected from her bow, and rebounded. A rent as big as a house was made in the side of the ship attacked, and she sank at once. The Thorneycroft only spun round and round for a few moments, and then returned uninjured to the squadron, from which she had started. A vessel of this kind is scarcely discernible in the water; even if she were detected, she is so small that it would be difficult to hit her; and half a dozen Thorneycrofts attacking a large vessel would be a most dangerous foe. Their expense is quite trifling compared with that of great ships of war; they can be multiplied indefinitely, and they can be carried on board other ships and be launched from them as occasion may require. The Italian Government has already carried out this idea in the construction of her formidable new ironclads Dandolo and Duilio. These vessels are fitted in their sterns with a sort of armored dry dock, harboring a small torpedo steamer. As soon as the services of the latter are required, the dry dock is filled with water and opened, and the little craft rushes out at the enemy, returning to her safe berth after her mission has been fulfilled. Admiral Porter's torpedo vessel Alarm, also recently illustrated by us, is fitted with spar torpedoes, both for bow and beam; but the torpedo generally supplied to all the cruisers of the United States is the

HARVEY (TOWING) TORPEDO.

Invented by an English officer in 1862, it was soon adopted by nearly all the other navies, and probably will be exclusively used in general actions at sea as least liable to injure a friendly vessel in the *mêlée*. The Harvey torpedo is towed upon the surface of the water by a wire rope towline from a derrick end of the yard arm over or against the enemy; and just before reaching the ship to be destroyed this towline is slackened, and the torpedo, being heavier than water, dives under it. When in this position the explosion is effected by means of a mechanical firing bolt striking down upon a pin as soon as certain levers of the torpedo come into contact with the bottom of the target. This torpedo can also be made to explode by electricity. Two different forms are used for starboard and port.

WHITEHEAD (FISH) TORPEDOES.

This invention is the secret and the property of the British Admiralty, but the following details have leaked out: These torpedoes resemble in shape a cigar, pointed at both ends, and are 18 feet long by two feet in diameter. The inside is divided in three different compartments: First, the head, which contains a charge of 350 lbs. of gun cotton and the pistol or detonator to explode it; secondly, the balance chamber, which contains a contrivance for setting it so as to remain at any depth at which it is wished to travel under the water line; and lastly, the air chamber, which contains the engines and the compressed air to drive them. The after end supports the screws—a right and a left handed—which propel the torpedo and are made of the finest steel. The air chamber is tested to the pressure of 1,200 lbs. on the square inch, although for service it is only loaded to 800 lbs. The Whitehead torpedo can be made to go at the rate of 20 knots for 1,000 yards, and at any depth that is desired from 1 foot to 30 feet. It can be set to explode either on striking an object or at any particular distance under 1,000 yards—in artillery language, either by a percussion or a time fuse. It can also be set so that, if it misses the object aimed at, it will go to the bottom and explode at half cock or come to the top on half cock so as to be recovered, as it has buoyancy enough just to float on the surface of the water when not in motion. It is fired from what is called an impulse tube, which, out of a frame fitted to a port, discharges the torpedo into the water. It can be fired above the water, but will at once go to the depth it is set for, and then go straight to the object, no matter how fast the ship from which it is discharged is going, or how fast the object aimed at may be sailing or steaming. It fact, it seems that it can do anything but speak. It is calculated to make a hole on bursting of 70 feet area, and there is no doubt that, if one of them hits a ship of any sort or description at present on the water, she must at once proceed to the bottom. It is evident that by this means a comparatively feeble ship, if only able to approach within 1,000 yards of a large one, can discharge a deadly flight of unseen projectiles at her, and at night such an attack will probably be wholly unsuspected and scarcely open to resistance, as the vessel fired against will be positively unaware of the attack until she is blown up. The newly invented electric light from the tops is a great help to the party attacked; but if three or four boats of great speed attack a vessel from different points of the compass, and if they are commanded by smart officers, nothing that she can do will save her from being hit by one or more of them. There is no doubt whatever that this torpedo is the most formidable weapon of modern naval warfare.

THE LAY TORPEDO.

Properly speaking, the invention of Mr. Lay, purchased by the United States Government, is not a torpedo, but a very ingeniously devised submarine torpedo boat fitted with a spar torpedo. This boat has the advantage of not requiring any crew on board, but in other particulars is capable of great improvements. The motive power consists of an engine driven by carbonic acid gas and a screw propeller. The boat is entirely submerged, and is steered and in all other respects controlled by means of an electric battery on shore, connected with her by a cable which is coiled up in her hold and pays out as she moves away. Her location is indicated above the surface of the water by a flag, so as to enable the operator to direct her course. The greatest defect of the Lay torpedo is want of speed. The United States Government stipulated for a speed of 9 statute miles per hour, but the maximum speed actually attained at the late trial trip, when it was steered by Lieutenant R. B. Bradford, U.S.N., showed only an average of 6·60 miles per hour, so that a ship attacked would only have to lower her boats and let them row between the approaching torpedo and the shore, and cut the cable, which would leave the torpedo at their mercy. The defence of ships against torpedo attacks of all kinds is at present very imperfectly developed, principally owing to the fact that the offensive qualities of any weapon must first be learned before effectual means of defence can be devised; and as actual warfare only can give a correct idea of the former, we are, no doubt, on the eve of very startling events, which may entirely revolutionize and change every recognized principle of naval tactics.

The great anxiety felt in England for the future safety and efficiency of the British navy, on account of torpedoes, is shown by the attempted formation of an International Torpedo Association, which Lieutenant Colonel Martin, of Boxgrove, Guildford, late commanding 4th (the King's own) Royals, is about to set on foot. He says in his programme: "When explosive bullets and chain shot were invented and actually used in war, nations unanimously agreed to discontinue their use and prohibit their manufacture; yet explosive bullets and chain shot, it must be admitted, are harmless as compared with torpedoes. Poisoning is prohibited in war. Why not prohibit torpedoes, which are actually more subtle and deadly than poison, there being no antidote to escape from them? For instance, were I allowed to fire (from a mortar) gutta percha bags filled with strychnine and charged with a burster and time fuse to cause the bag to burst and scatter its diabolical contents over some obstinate city or fort which would not capitulate, this visitation would be far more merciful in its way towards the people of that city or fort than torpedoes would be against crews of ships, because the strychnine could be seen and avoided by flight; whereas, on the other hand, torpedoes secretly moored, or even fish torpedoes, insure complete, sudden, unexpected, and unavoidable destruction. Several clever artisans have already been killed by merely pumping compressed air into the tails of unloaded fish torpedoes. Had these torpedoes been loaded with gun cotton for service on board ship, and even if one of them exploded from careless handling during action while compressed air was being supplied to start it, or if by chance a shot or shell struck the ship at the time of starting a fish torpedo on its death track, the fearful consequences may be easily imagined. As a proof that governments appreciate the danger they incur by the use of torpedoes, I may here state that it is well known that, after the Austro-Italian war, all the picked-up torpedoes proved to be dummies. It is our bounden duty to keep pace with other countries, but every one will admit that the sooner the "International Anti-Torpedo Association has accomplished its task, the better for the cause of humanity!"

It is much to be feared that other nations will prefer to take a different view of the case, and continue to consider torpedoes a cheap and effective counterpoise to the costly and powerful English ironclads.

American Silk Manufacture.

A recent report of Mr. F. Allen, Secretary of the Silk Association of America, states that the total manufactures of silk in this country for 1876 were valued at $26,593,103. The business of last year is not considered satisfactory, although the raw silk consumed was within 150,000 lbs. of the largest amount used in any previous year. This unsatisfactory condition is ascribed to the use in the price of raw material, amounting on the average to 100 per cent; to the pressure brought to bear on our markets for goods by foreign manufacturers who had injured their markets abroad by excessive adulteration, in some cases reaching more than threefold the weight of the silk; and to the great extent of frauds by undervaluation at the Custom House. The estimate of loss to the revenue from the last named cause alone is placed at $4,000,000.

Titanic Iron from the Ural.

J. Popov has recently published analyses made by him of two titanium minerals from the Ural. The first is an ordinary titanic iron ore, containing magnesia; the other a perimorphose of the same in which the iron seems to be replaced by lime, only half a per cent of protoxide of iron remaining. The iron ore contained: Titanic oxide 56·81 per cent., sesquioxide of iron 4·02, protoxide of iron 19·65, protoxide of manganese 1·73, protoxide of magnesia 17·18; total 99·39. The perimorph contained: Titanic oxide 58·65, lime 40·83, protoxide of iron 0·58; total, 100·26.

IMPROVED FRICTION HOISTING ENGINES.

We illustrate herewith a series of improved hoisting engines, adapted for the removal of cargoes from vessels and stone from quarries, and for pile driving, and all the various uses to which such machinery is usually applied.

Fig. 1 represents a double drum and double cylinder. The engines are each of 8 horse power, and work independently of each other. The apparatus allows of work being carried on at both hatches in a vessel at once. It is also especially adapted for use in the erection of large buildings where there are two hod elevators, operated at one time, for hoisting building material. The apparatus is mounted on wheels so that it can easily be moved from place to place. The engines have plain slide valves, worked by an eccentric direct from the main shaft. There are locomotive slides and crosshead of simple construction. Both engines are supplied with steam from the same boiler, which, in common with other generators used on these machines, is made of the best charcoal hammered iron $\frac{5}{16}$ inch thick, with longitudinal seams double riveted, heads $\frac{3}{8}$ inch thick, with best fire box and flange iron in the furnace. The boiler is supplied with water by a steam pump attached to it on one side, and an injector on the other. We are informed that, by this machine, 1,980 tons of merchandise, consisting of bag sugar, linseed, jute, etc., were discharged from a vessel in 31 hours, and that 400 hogsheads of sugar were hoisted out in 3 hours' time.

Fig. 2 represents an improved double cylinder and double drum pile-driving machine for dock builders' and contractors' use. Both engines are connected to the same shaft at right angles. The steam cylinders are 7x12 inches, one drum being used for running the hammer, the other for hoisting the piles. There is also a winch on the end of the lower drum shaft, for the purpose of handling the machine or timber, or for any extra work needed. This engine, it is claimed, will strike, with a 2,500 lbs. hammer, from 15 to 20 blows per minute, lifting the hammer from 12 to 20 feet high at every blow. It is also useful in working a boom derrick when the load is to be raised by one drum, and the boom raised or lowered and swung by the other. The weight is held by the improved ratchet on the end of the drum, as shown in the engraving.

These machines can be seen at work in various localities in New York and Philadelphia. The manufacturer states that one of the 40 horse power double cylinders, 10x16 inches, has raised a weight of 30 tons over 22 feet high, and lowered it successfully by the friction gearing, at the marble yards at the foot of Corlears street, East river, in this city. Fig. 3 shows a section of the friction drum, patented through the Scientific American Patent Agency, January 19, 1875. The drum is cast in one piece. The large gear is made with holes or pockets in the side to receive plugs of hard wood, that are fitted in and turned off to receive the cone flange of the drum. The spiral spring between the gear and drum forces the drum off the wood when relieved by the screw and pin at the other end. This can be used separate from the engine by the application of a belt on the pulley on the lower shaft, for hoisting in warehouses, stores, coal yards, or in any place where there can be power attached. The friction gearing serves as a brake in lowering fast or slow, at the option of the operator.

Fig. 4 represents a single machine mounted on trucks, and adapted to all kinds of light or heavy hoisting. The engine can be run as a stationary engine, by applying a governor to the steam pipe and taking power from the flywheel by a belt. At the same time it may be used for any kind of hoisting, the weight being held by a brake band, applied to the drum when the engine is in motion. The manufacturer also builds a special mining engine, with large grooved drums for using wire rope; also an improved self-propelling boom engine, for hoisting stone or marble on the walls of high buildings, a mast 100 feet high being carried on the end of the engine, for the purpose described.

For further particulars, address the patentee, J. S. Mundy, 7 Railroad avenue, Newark, N. J.

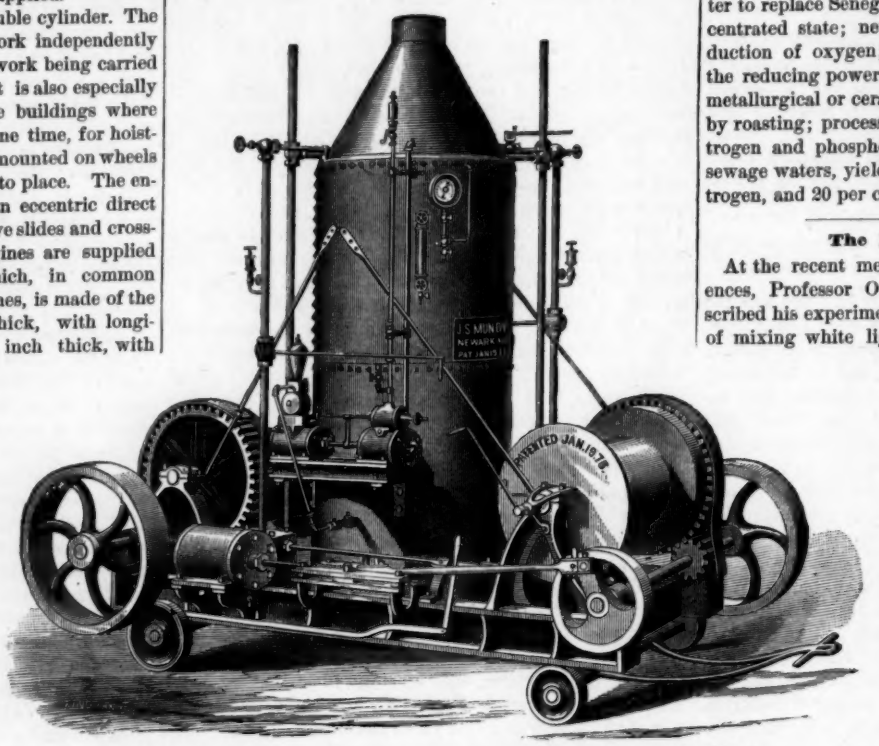


Fig. 1.—MUNDY'S DOUBLE DRUM PORTABLE HOISTER.

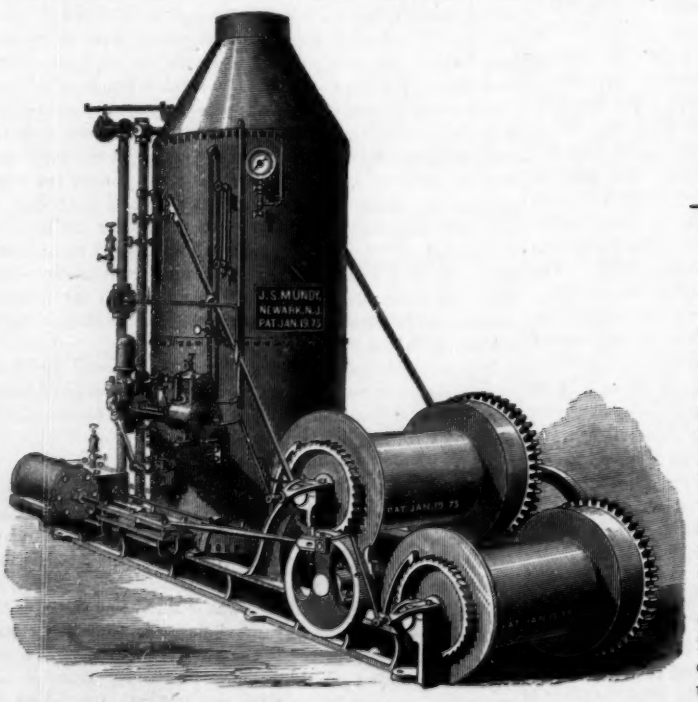


Fig. 2.—MUNDY'S DOUBLE PILE-DRIVING MACHINE.

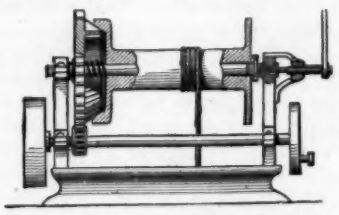


Fig. 3.—MUNDY'S FRICTION DRUM.

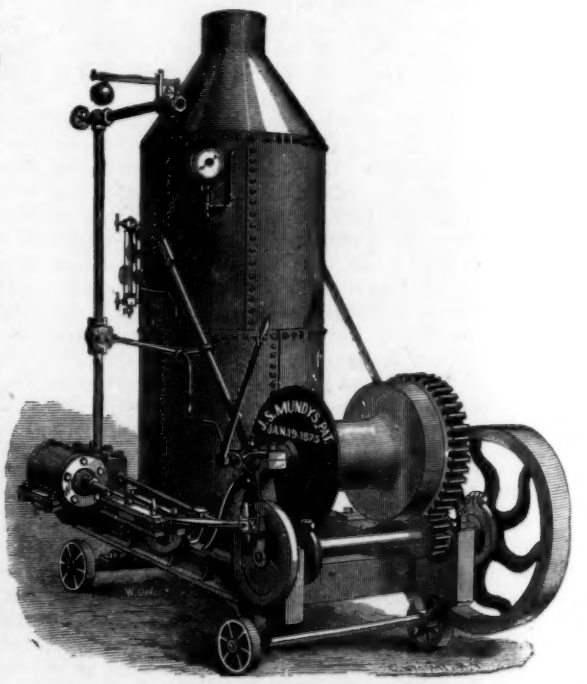


Fig. 4.—MUNDY'S PORTABLE HOISTING MACHINE.

New Ocean Steamer.

The Niagara, a new iron steamer for the Havana trade, built for J. E. Ward & Co., New York city, was lately launched from the yard of John Roach & Co., Chester, Pa. The model of this ship is said to be very fine, and she is to be engined with powerful machinery, so as to make an expected speed of thirteen knots. The following are her dimensions: Length, 294 feet; breadth of beam, 38 feet 8 inches; depth from hurricane deck, 31 feet, and from main deck, 23 feet 9 inches, with a displacement of 2,400 tons. She is furnished with one compound engine of 1,650 horse power, the cylinders being 34 and 60 inches in diameter, with 54 inches stroke, driving a four-bladed screw of Hirsch's patent, calculated to give the vessel a speed of 13 knots an hour. Her boilers, four in number, are of the cylindrical tubular pattern, 10 feet in length by 11 feet 10 inches in diameter, tested to a working pressure of 80 lbs. to the square inch. She will be brigantine rigged, and spread about 2,500 yards of canvas. The steering apparatus, and the capstan for heaving up the anchor and warping the vessel, will be operated by steam. The saloon and staterooms will be elaborately finished. The vessel is divided into five water compartments and three decks. Cost upon completion, $350,000. A sister ship to the Niagara, the Saratoga, is in course of construction at the same yard, and will be ready for launching about July 1.

Industrial Prizes.

Among various subjects, in connection with which the Industrial Society of Rouen has just offered prizes, are the following: A substance capable of replacing albumen of eggs in all its applications to printing of tissues, and considerably cheaper; new source of albumen, either in natural products containing it, or by transformation of other proteic matters; a new dark color as intense and solid as aniline black, but not weakening the cloth, and capable of being printed with any other colors without alteration at the point of contact; a method for volumetric determination of commercial glycerine; a solid blue coloring matter, applicable like indigo but cheaper; new process for fixing indigo blue by steaming; new method of fixing aniline colors; a new thickening matter to replace Senegal gum; production of ozone in the concentrated state; new application of ozone; industrial production of oxygen; rapid and exact means of determining the reducing power of a coal or any carbon; utilization, in metallurgical or ceramic arts, of iron pyrites, desulphurized by roasting; process of concentration or precipitation of nitrogen and phosphoric acid in fecal matters, urines, and sewage waters, yielding a manure of at least 5 per cent nitrogen, and 20 per cent phosphoric acid.

The Mathematics of Light.

At the recent meeting of the National Academy of Sciences, Professor O. N. Rood, of Columbia College, described his experiments in testing mathematically the effect of mixing white light with light of different colors. He used brilliantly colored disks made to revolve rapidly, and substituted in part of each disk white for color, measuring the amount of substitution and its specific effects. Thus mingled with white, the lighter shades of vermilion became purplish; of orange, more red; of yellow, more orange; of greenish yellow, unchanged; of yellowish green, more green; of green, blue; of cyanogen blue, less greenish and more bluish; of cobalt blue, more violet; of ultramarine, violet; of violet, unchanged; of purple, less red and more violet. Exactly the same results followed when violet was used instead of white to reduce the colors. Hence mixture with white has an effect similar to moving all the colors towards the violet end of the spectrum. Professor Rood regards these and other experiments of a qualitative nature, as indicating that violet is one of the primary colors. The mathematical results attained were laid before Mr. Charles S. Pierce, who subjected them to further analysis, and found that they confirmed Fechner's law, that "the sensation is proportional to the logarithm of the excitation." A diagram has been made showing the effect upon any of the spectrum colors of admixture with white; the diagram is constructed on the mathematical theory; the observed results in practice correspond.

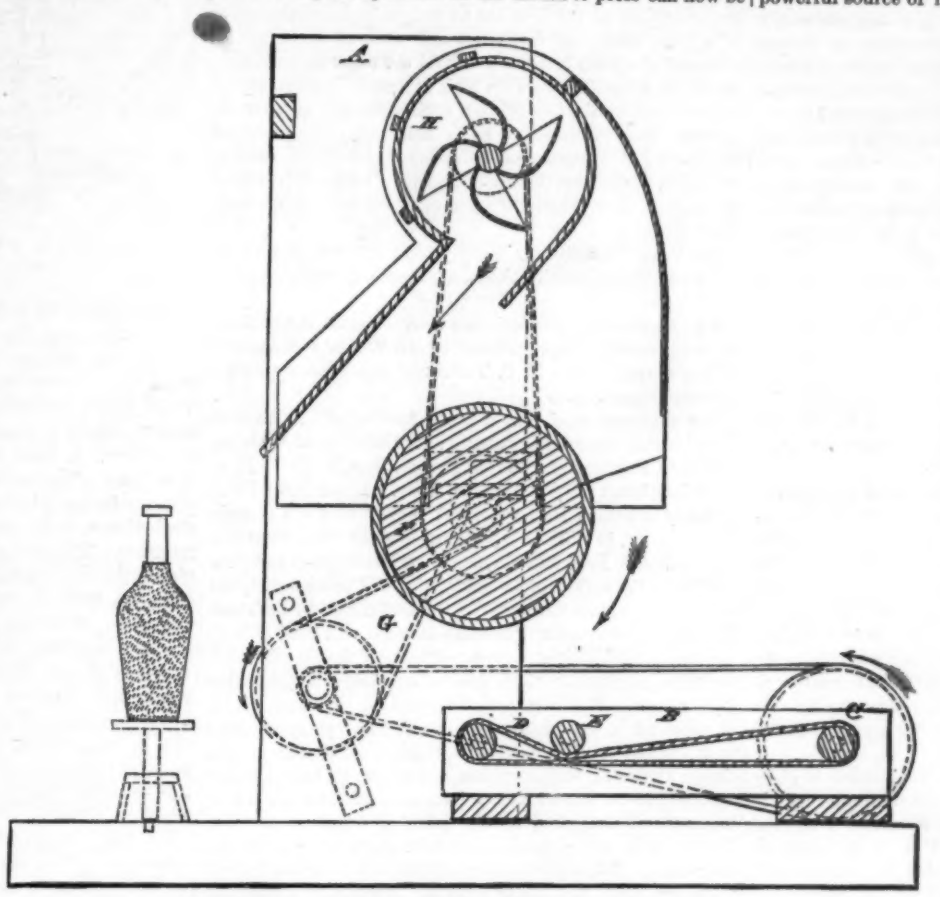
Electro-Magnetic Plant.

A curious plant, called the *phytologica electrica*, and possessing strong electro-magnetic qualities, has been recently discovered in Nicaragua, according to the New York *Herald*. The hand is lamed by touching it, and the magnetic influence is felt to a distance of eight feet. The magnetic needle is disturbed, and the nearer the middle of the plant is approached the stronger becomes the agitation, until finally it assumes a circular movement. The intensity of the phenomenon varies according to the time of day, and at night is scarcely perceptible. It reaches its highest point about two o'clock in the day. Stormy weather increases its activity. No insects or birds are known to approach it.

THE Rev. S. S. Whitmee, of Australia, in an extremely able and interesting lecture on "the Ethnology and Philology of Polynesia," contended that over all Polynesia there are two distinct types of people, a brown race connected with the Malays, and a negro race, with the Papuans. There is a third much mixed race, name and origin unknown.

TWO NEW UTILIZATIONS OF PAPER PULP.

We illustrate herewith two new sets of apparatus for making paper pulp into either small vessels or barrels. The first, illustrated in Fig. 1, is an improved machine for depositing paper pulp upon moulds in order to form bottles, pitchers, and other vessels of *papier maché*. A is an upright frame, to which is attached a trough, B. To the end parts of the frame, B, are pivoted two rollers, C, around which passes an endless belt, D, made of wire cloth. To the forward part of the frame, B, is pivoted a third roller, E, beneath which the carrier, D, passes, so that the distributing fingers can only come in contact with its forward part. A drum, F, has rows of spring fingers, G, of such a length that their ends will come in contact with the forward end of the carrier, D, to take particles of pulp from said carrier, and project them upon the object to be coated, in front of the machine, and slowly revolved. The particles of pulp are directed more accurately against the article to be coated by the blast from a fan blower, H. In this way bottles, pitchers, and other vessels may be quickly and evenly coated with pulp, or coatings of pulp may be deposited upon forms, from which they may be withdrawn, when dry, by slitting them. The pager pulp coatings, when dry, may be polished, varnished, and otherwise finished.

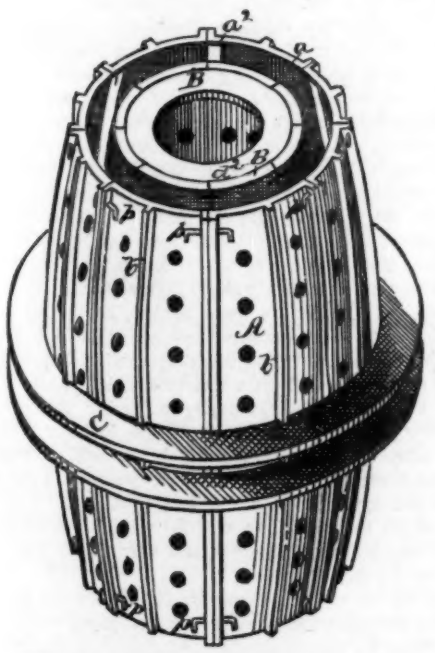


JENNINGS' PAPER PULP DISTRIBUTER.—Fig. 1.

Patented through the Scientific American Patent Agency, March 13, 1877, by Mr. Isaac Jennings, of Fairfield, Conn.

The second invention, illustrated herewith in Fig. 2, has for its object the production of a barrel or other similar article of any convenient size, and composed of ordinary straw pulp, made of straw or other suitable raw material. To this end, therefore, the invention consists of a mould or form in which to compress the pulp into proper shape.

A represents a number of staves, preferably of metal, their interior surface having the form desired for the exterior of the barrel. B B are a number of staves or sections, which, when set up inside the staves, A A, form a cone having an exterior form corresponding to that desired for the interior of the barrel. C C are rings, which are passed over the ends of the staves, A A, in the manner of hoops upon a barrel, and by their pressure preserve the external form of the mould. The stave, A, is perforated, as shown, and on its inside over the perforations is secured in



HUBBARD'S PAPER BARREL MOULD.—Fig. 2.

any suitable manner a wire gauze or similar device, *a*. Upon the inner edge of one side of the stave is secured a strip of thin metal forming a rabbet, a^1. This rabbet prevents the pulp from being forced out between the staves as the pressure increases, before the edges of the staves form a tight joint. Upon the back of the stave are three ribs, two of which form the edge of the stave, A, and one is a central rib, *b*. Each end of the sections, B, is formed into an offset for giving a croze or some similar formation to the ends of the barrel when pressed into shape, and said sections are perforated and covered on their exterior surface with wire gauze in the same manner as is the interior surface of the staves, A. The sections, B, are also provided with lugs, *d*, which serve to steady the sections and assist in holding them together when setting them up before pressure is brought upon the mould by serving as supports for the rings, d^2. One of the sections, B, has its edges beveled the reverse of the others, by which means it can be readily removed from the mould when the barrel is made, after which removal the other sections may be easily taken out also. The ring, C, is provided with slots or notches, *e*, which notches guide it as it is forced upon the staves, A A. These staves are also held together by wire pins, *p p*.

The complete operation of the mould or press can now be understood. The staves and sections being all set up, as above described, and the annular space between them filled with any suitable pulp, the rings, C C, are forced over the staves, A, by screw power, when the pulp will be compressed, as the rings approach each other, into the desired shape, the water contained in the pulp at the same time being forced out through the perforations in the staves and gauze. The shaped pulp, still under pressure, may now be subjected to any suitable drying process, the heat reaching it through the wire gauze and the perforations in the staves, both from the inside and outside. When the shaped barrel is considered dry enough, the rings, C C, are removed from the staves, A A. The staves thus released from pressure can readily be withdrawn, as above described, from contact with the barrel, and the barrel, as a completed article, is ready to be headed in any desired manner.

This invention was patented February 1, 1876, by Mr. Eber Hubbard, of Medina, N. Y.

THE NEW GODEFROY BURNER.

M. Godefroy's new burner, which is represented in the annexed illustration, is composed of four concentric sheet iron cylinders. The first and third are pierced with lateral holes at the base. The intervals between the cylinders communicate, some with the pipes, t^1 and t_2, joining the exterior gas tube, T, and others with the tubes, t_3, t_4, which unite with

the tube, T_2. Wire gauze placed at the base of the apparatus prevents the flame from flickering, while it regulates the introduction of the air. Only two internal cylinders may be used if desired, in which case a high and regular white flame is produced.

THE ELECTRIC CANDLE.

The Jablochkoff electric candle, which we briefly described some months ago, on the occasion of its introduction to the French Academy of Sciences by its inventors, is now being used in Paris for the illumination of large stores. As the matter of lighting the streets of large cities by the electric light has of late been somewhat discussed, this invention is of timely interest, more especially as it appears to afford a new and simple means for employing that most powerful source of illumination.

The electric light, as all are aware, is now produced by means of two rods of carbon placed end to end, the extremities separated by a distance of some hundredths of an inch. Through the carbons a powerful electric current is passed, which, if the rods touch, simply heats them; but if they are separated, as above mentioned, it causes the production between the ends of the intensely luminous voltaic arc. As the rods become consumed, the arc elongates; and, finally, when the distance becomes too great, it ceases. Consequently, unless machinery is provided which compensates for this consumption by maintaining the ends of the rods always at the proper distance, the arc cannot be kept for longer than a few minutes. Electric lamps therefore are provided usually with clockwork or electro-magnetic devices for this purpose. When the source of the electricity is a battery or a continuous-current electric machine, such as the Gramme, the two rods are unequally consumed, that at the positive pole disappearing about twice as fast as the other. With other machines, whereby the current is alternately reversed, the consumption is about uniform for both.

The disadvantages attending even the most improved lamps, such as the Serrin apparatus, for example, lie in the care and attention required by the delicate mechanism, the difficulty of regulation, the casting of a shadow by the mass above the arc, the necessity of renewing the carbons at intervals of three hours, the consequent extinction of the light, and finally the high cost. It is simply necessary to point out that M. Jablochkoff's candle aims to do away with all of these difficulties to show the importance of the invention.

The device is represented in its full dimensions in the annexed engraving, for which we are indebted to *La Nature*.

It is an asbestos ferrule, sustaining the two gas carbon rods, C, which are also held in copper tubes, T. At I is insulating material placed between the rods, and at F the conducting wires. This arrangement may of course be modified to suit differing circumstances. The insulating material is kaolin or other refractory substance which does not extend to the ends of the rods. When the current passes, the arc is produced between the extremities of the carbons; and as these become consumed, the light is gradually brought near to the refractory substance. This by the great heat is vaporized, in proportion as the rods burn away, so that protruding ends of the latter are always left, while they are always maintained at exactly the proper distance apart to which they are in the beginning adjusted. If a continuous current is used, the double consumption of the positive rod is provided for by making that carbon of double the area of section as compared with others: but the candle works better with alternating currents, in which case the carbons are of the same size. It is easy to reverse the apparatus so that the arc is produced at the lower ends of the rods. The candle may then be employed for an overhead light.

One of the principal advantages of the Perrin lamp is that it may be set in operation from a distance by merely establishing the current, the carbons having been previously prepared. M. Jablochkoff accomplishes this by placing a bit of carbon between his points. When the current passes, this becomes hot, reddens, and finally consumes. Continuity is then broken, and the arc appears. A bit of lead, or fine metallic wire, which melts easily, answers the same purpose.

The gradual fusion of the insulating material presents another advantage, namely, that it becomes conductive on attaining the liquid state, and admits of an elongation of the arc, which increases the light. This conductibility, moreover, admits of the candle being extinguished by the breaking of the circuit and then re-ignited, provided the interval is not longer than a couple of seconds. By this means, it is suggested, the candle might be employed as a means of transmitting signals by flashes, using the Morse telegraphic alphabet. This idea has already been adopted by the Russian army, and trials are soon to be made at the headquarters at Kischenew.

With the ordinary electric lamp, it is not possible to place more than one pair of carbons in the same circuit. This is owing to the necessity of regulation in apparatus where the movement of the rods is accomplished by electromagnetic machinery, which itself is dependent upon the variations of the resistance of the circuit produced by the changes of length of the voltaic arc. If the arc elongates, the resistance augments; the electromagnet weakens, and allows of the relative approach of the carbons. Consequently, if two lamps were placed in the circuit, and one arc elongated, both electromagnets would be affected, and hence both arcs would be shortened. So that the inter-relation of the two machines would constantly produce improper regulations, which would amount to no regulation at all. With the candle, however, it is immaterial how many are placed in the same circuit, provided the current has sufficient tension to pass through all. In Paris, three and four lights have been maintained from a single electric machine.

M. Jablochkoff is at work on further improvements, some of which he has perfected, and will shortly lay before the French Academy of Sciences, when we shall present them to our readers. It will be seen, however, that the invention is one calculated greatly to extend the usefulness of electric illumination.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

An application having been made by S. D. Locke to Secretary Schurz for an order directing the Commissioner of Patents to rehear the case of Withington *vs.* Locke, on the ground that the case was heard by the Assistant Commissioner at a time when the Commissioner of Patents was present and attending to his official duties, the Secretary has made a decision, denying the application, reviewing and reaffirming the decision of Secretary Delano in the quadruplex telegraph case, as to the right of the Secretary to interfere with the acts of the Commissioner of Patents, when honestly performed. There is no complaint made on this score; and the attorneys of both parties appeared before the Assistant Commissioner and fully argued the case, thereby tacitly admitting his competence to decide the case. No objection was made by either party until the matter was decided, when the defeated contestant made this application. After referring to the long-continued practice of the Office for the Assistant Commissioner to act on cases when the Commissioner is otherwise engaged, the Secretary says: "The duties of the Assistant Commissioner have been, and are, such as the title of his office supposes; and I am of the opinion that where parties, as in this case, submit their proofs and arguments to that officer, with a full understanding of the practice so long established, they must abide by his decision or seek their remedy in the courts."

An appeal from the Board of Examiners-in-Chief having been taken by John N. Swift, an applicant for the registration of a trade mark which had been previously registered by Winfield Peters, February 29, 1876, the Assistant Commissioner affirms the decision of the Interference Examiner and the Board of Appeals. The trade mark in question is "The John C. Ragsdale Ammoniated Dissolved Bone." The name of Ragsdale is that of a gentleman who was president of an agricultural society in Georgia, and his name was taken, by his consent, to popularize the article in that locality. Swift, having been appointed to negotiate with manufacturers for the introduction of this and other brands of fertilizers, made a contract with the firm of Snowden & Peters to furnish the article under this name, which firm afterwards dissolved, and Peters registered the trade mark in his own name. Unlike applications for patents, priority of conception of the idea has no weight in the registration of a trade mark, and Swift not only fails to show that he ever used the trade mark, but he sold the manufactured article of Snowden & Peters on their account. The rights of Snowden or of the agricultural society are not at issue in this case, and are therefore not considered. The Board of Appeals decided the case in Peters' favor, which this decision affirms on the ground that Swift had never adopted or owned the trade mark at all in the sense contemplated by the trade mark law.

Mr. T. C. Connolly, for many years a Primary Examiner, has been reduced to First Assistant Examiner—cause said to be old age.

As a result of the competitive examination for the position made vacant by the appointment of Mr. Wilber as Examiner of Interferences, Mr. H. C. Townsend has been appointed Primary Examiner.

The exploration of our Western territories will be continued during the coming summer under Lieutenant Wheeler, Professor Hayden, and Major Powell, though the field of operations is not fully determined upon. Major Powell will probably continue the geological survey of the Colorado river country, in which his party has already made extensive explorations. Professor Hayden's exploring party last year completed the survey of Colorado, and will make during the summer an exploration north of the Union Pacific Railroad. The main party under Professor Hayden will make Cheyenne their headquarters, and the different divisions will reach the principal points of their fields of operations by the Union Pacific road. The northeast division will be under Mr. G. B. Chittenden, and operate in the Sweet Water and Mud river countries. The southwest division, in charge of Mr. Henry Gunnett, will examine a section of about 10,000 square miles in area on the western slope of the main Rocky Mountain range. The northwestern division, under Mr. Bechler, will survey an equal amount north of that already referred to. This part of the country is of more rugged character than the other sections, embracing within its limits features of surpassing interest. Its topography, geology, and natural history are more remarkable than any of the other sections. The various parties are made up, and will probably have left for their field of operations ere this is published.

Secretary Evarts is represented as expressing regret at the postponement of the extra session of Congress, as it may prevent the representation of the United States at the approaching exposition at Paris. He thinks, however, that a Commission may be appointed which would in part reciprocate the French representation at the Centennial Exhibition. It is probable that a formal communication will be addressed to the French Government explaining the situation. The Secretary thinks, however, that, if Congress when they meet should act promptly in the premises, there would still be sufficient time to organize a respectable representation of our products and manufactures.

The Bureau of Statistics has published a statement showing that the exports of "oleomargarine" or "butterine," from New York, during the seven months ending March 31, amounted to 3,549,629 lbs., of the value of $481,747, of which 2,352,250 lbs. were shipped to France and 991,329 to Great Britain. This probably accounts for a discovery that the English people have lately made that a large quantity of very nice-looking butter, said to have been imported from the island of Jersey, had never been made in Jersey at all; and they were puzzling their brains to find out where it had come from—having very strong suspicions that it was not really butter but oleomargarine.

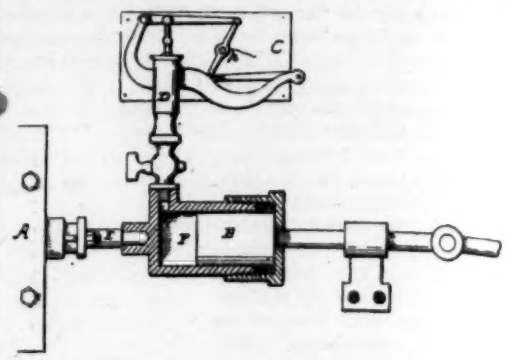
Our Board of Health has condemned a thousand barrels of an article sold in this market by a Chicago firm for vinegar, which, when tested by the chemist, was found not to be vinegar, but a compound containing $54\frac{54}{100}$ grains per gallon of anhydrous sulphuric acid combined with lime to form sulphate of lime (equivalent to $117\frac{54}{100}$ grains of gypsum per gallon) and 5 grains free sulphuric acid per gallon. This stuff is probably shipped all over the country, because it can be made so much cheaper than pure vinegar; and the people should therefore be warned to notice whether they are buying vinegar or diluted sulphuric acid.

Washington, D. C. OCCASIONAL.

A Practical Method of Determining the Friction of Slide Valves.

To the Editor of the Scientific American:

There has recently been considerable discussion of late concerning the friction of slide valves, from which it appears that there is a wide difference of opinion among mechanical engineers on this subject. I propose to show a method by which the friction of a slide valve may be measured; and for that purpose I have designed the instrument shown in the engraving. It is intended for taking diagrams which will indicate the frictional resistance of a steam engine valve at every part of its stroke. In the engraving, E is a valve stem of a steam engine, which works a valve within the steam chest, A. Attached to the end of this valve stem is a cylinder, F, which is provided with a nicely fitting piston, B. The stem of this piston, B, is joined to the eccentric rod of the engine. A common steam engine indicator, D, is connected with the upper part of the cylinder, F. If the cylinder chamber is filled with water, and the piston, B, is



driven forward by the eccentric (the water in the chamber being confined and inelastic), the motion of the piston will be communicated to the valve stem, and all the parts will move forward together as if they were rigidly connected. The cylinder, F, has an external nut by which the valve is drawn back in the opposite direction, and which prevents the piston, B, from being withdrawn from the cylinder. The thrust of the eccentric on the piston, B, will produce a pressure in the cylinder which will cause the pencil, *p*, of the indicator to rise and fall as the pressure increases or diminishes. The card, C, on which the diagram is drawn, is placed flat and stationary (instead of being mounted on a cylinder), while the indicator is carried back and forth with the valve. When the pencil, *p*, is brought in contact with the card, and the valve is moving forward, a diagram will be drawn, with a length equal to the stroke of the valve, which will indicate the pressure at every part of the stroke. The mean resistance of valve and power absorbed in foot lbs. can be determined by the usual method of working out steam diagrams.

If we wish to know the percentage of power of the engine which is absorbed in moving the valve, let a diagram be taken from the cylinder of the engine, and during the same stroke let a valve diagram be taken; then the foot lbs. of work developed by the engine may be compared with that absorbed by the valve. It may be said that the upward movement of the indicator piston would reduce the travel of the valve; but if the piston, B, is made sufficiently large, this reduction would not be of practical importance.

Indianapolis, Ind. JOHN C. DEAN.

The Origin of Petroleum.

To the Editor of the Scientific American:

On page 294 of your current volume, I notice an article on a "New Theory of the Origin of Petroleum." The idea may be new in print; but I heard it advanced during the winter of 1865–66 by a Mr. Smith, then a resident of Enterprise, Pa. He said: "By volcanic action, the earth's crust was broken, leaving crevices through which the ever-present water poured, which, coming into contact with the heated matter near the center of our globe, formed a gas which, in seeking outlets through the earth's crust, became more or less pent up, and necessarily would condense, forming our petroleum." He did not, as our friend in Russia has done, tell the nature of the matter with which the water comes in contact, but gave the idea generally. I think he wrote on this subject either to a Titusville (Pa.) or an Erie (Pa.) paper; but as to that, I am not certain. I remember, however, that he had a number of pretty sharp arguments with oil men on this theory. Mr. Smith went further, accounting for the gas that escaped the condenser by saying that "it passes into the air, forming into globe-like shapes, which in passing upward gather around them a moisture which of course confines them until, by gradually gathering this moisture (thereby gathering weight), they settle little by little until they mingle with the clouds, which generate electricity, or at least contains it, and are exploded by a spark, causing the flash and explosion—thunder and lightning." The latter part of his theory may be a little "airy;" but we must in some way dispose of this gas, and why not in this way as well as any other?

I think this will prove that we as a people are not so far behind the old world as such "credits" make us appear.

Buffalo, N. Y. L. E. PORTER.

Poisonous Enameled Ware.

Much consternation has lately been caused by the announcement in certain Boston papers that the enamels on the so-called marbleized and granite ware, which have for the past year or more found ready and extensive sale in our markets, have been found to contain lead and arsenic. The ware is quite handsome, of a mottled gray and white color, resembling somewhat certain varieties of marble in appearance. The vessels (principally culinary utensils) are in general enameled both inside and out. It will be seen from the letter given below that the statements as to the objectionable character of these enamels are not wholly without foundation in fact. The manufacture of the "marbleized" ware were awarded a medal in the Centennial Exhibition last year; and in the report of the judges, we find the state-

ment that the marbleized ware "differs from all other enamels in that it contains no poisonous or injurious substances whatever," and that "it is unaffected by excessive heat, or acids of any description."

We have received the following from Professor S. D. Hayes, the State Assayer of Massachusetts:

To the Editor of the Scientific American:

It will be replying to many inquiries about enameled ware if you will kindly give this note a place in your columns. I have recently analyzed various specimens obtained in the open market, from dealers, kitchens, agents, and directly from the makers of these wares, and I have seen them manufactured. The wares to which I refer now are known respectively as "marbleized" and "granite" iron wares, resembling each other so much in their mottled gray color that they are not easily distinguishable by persons unfamiliar with them.

The marbleized ware, as hitherto manufactured, contains considerable lead in a soluble form, with a little arsenic, and it should not be used in cooking or drinking vessels, although there is no objection to it for other purposes. Oxide of lead adds to the elasticity and fusibility of the enamel, so that there is a temptation to use it on the part of the workmen in the factories. But serviceable enamel ware can be produced without it, and I have analyzed pieces made within a few days, by the manufacturers of the marbleized ware, that are free from deleterious ingredients.

Some of the pieces of granite ware analyzed contained a small proportion of antimony (about one per cent), which is not a dangerous element in the enamel; and as there is nothing else present that is injurious, it is safe for use in the kitchen or elsewhere. The other pieces of granite ware contained no soluble metals whatever, excepting iron, and they are entirely harmless in composition.

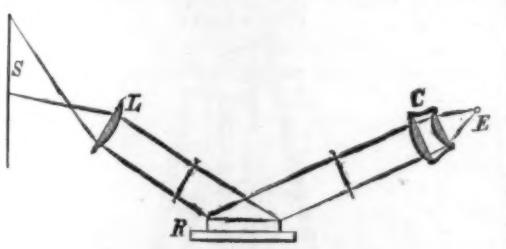
Boston, Mass. S. DANA HAYES,
State Assayer and Chemist.

PROJECTION OF INTERFERENCE COLORS FROM SOAP FILMS.

BY HENRY MORTON, PH.D.

Among all the phenomena of light, none are of such fundamental interest as those of interference; for none have a closer relation to the first principles of our theory as to the nature of light, or are so constantly coming up in all parts of the subject in connection with the most beautiful developments of color, as for example in the diffraction spectrum and in chromatic polarization. Yet until recently no means has been at command for exhibiting directly by projection this phenomenon in its characteristic beauty. Now, however, in the simple arrangement which I am about to describe, we have all that could be asked in this connection.

The arrangement is as follows: We place the electric light, E, in the lantern and remove the front element of the condensers so that the light comes out in a nearly parallel beam. The lantern is then turned obliquely towards the screen, and at the distance of about six inches from the condensers, C,



is set the soap film ring, R, with the soap film on its face. In such a position as to receive the light reflected from this film, is placed a plano-convex lens of about 12 inches focus, and about 4 inches diameter, which is adjusted back and forth by trial until the best effect is obtained on the screen. This effect is to begin with a gradually changing field of the most brilliant color, with occasional irregularities, but essentially passing through the tints of the spectrum to a deep violet blue.

When this point is reached, the ring, R, is to be rotated in its own plane a half revolution, so as to bring the lower part of the soap film to the top. The result of this is the flowing down over the film of various thicknesses of solution from the accumulation of its lower edge, now suddenly brought to the top. These varying thicknesses produce the most brilliant colors, and, by reason of this and the graceful cloud-like forms which are assumed, develop a spectacle with which I know of nothing comparable, unless it be one of the most gorgeous sunsets I have ever seen. Purple, crimson, gold, blue, and green, exquisitely blended and of intense brightness, are some of the tints.

The idea of making the ring rotate, so as to secure this effect from the flowing of the soap solution, originated with my friend, Professor George F. Barker, of the University of Pennsylvania, and rings of a very satisfactory character, involving several little matters of detail, are manufactured by Messrs. George Wale & Co., of Hoboken, N.J. The solution for the soap film is best made as follows: *a*. Take olive oil soap (white Castile soap), cut it into shavings with a plane, and dry thoroughly. Dissolve these shavings in alcohol until the alcohol is saturated. The solution should show a specific gravity of 0·880.

b. Mix glycerin with water until it shows 17·1 Baume. To make the final solution: To 6·102 cubic inches of solution *b*, add 1·53 cubic inches of solution *a*, and boil until the alcohol is all expelled. This is obtained when the boiling point rises above 212° Fah. Cool, and turn into a graduated flask, and add water until the volume is again 6·102 cubic inches. Filter, if necessary, to remove oleate of lime.

Some of this solution being poured into a small plate or shallow dish larger than the soap film ring, bring the latter, face downwards, upon its surface, until the edge is just immersed, and then, keeping the face horizontal, raise gently and turn into an upright position. Should there be drafts in the room, an ordinary glass shade may be placed over the soap film ring, without interfering with the experiment, and the film will then be more persistent and safe.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the object mentioned. M. M.

Positions of Planets for June, 1877.

Mercury.

Mercury rises on June 1 at 4h. 19m. A.M., and sets at 6h. 29m. P.M. On the 30th, Mercury rises at 3h. 17m. A.M., and sets at 6 P.M.

The best time for seeing the planet is on the morning of the 20th, when it is furthest from the sun and rises an hour before it.

Venus.

On June 1, Venus rises at 4h. 57m. A.M., and sets at 7h. 57m. P.M. On the 30th, Venus rises at 5h. 41m. A.M., and sets at 8h. 35m. P.M.

Venus is small, but bright; and after the middle of the month it can be seen for nearly an hour after sunset, following almost exactly the path of the sun.

Mars.

On June 1, Mars rises a little after midnight and sets at 10h. 25m. in the morning. On June 30, Mars rises at 11 P.M., and sets at 9h. 38m. the next morning. Mars is in southern declination among the small stars of *Capricornus* and *Aquarius*, but is moving toward the north, coming into better position and increasing in apparent size.

Jupiter.

Jupiter is brilliant now in the southern sky, and will be in its best position about the middle of June. On the 1st, Jupiter rises at 8h. 50m. P.M., and sets at 5h. 51m. the next morning. On the 30th, Jupiter rises at 6h. 41m. P.M., and sets at 3h. 41m. A.M. the next day. Jupiter souths at midnight on the 20th at an altitude of 25° 10′ in this latitude.

The various changes of Jupiter's four moons can be seen with a small telescope, and many of the most interesting occur in June. On the 12th, Jupiter will be seen with only three moons until after 9 P.M., when the 1st moon will reappear from behind the planet. On the 19th, the 1st satellite will disappear between 8 P.M. and 9 P.M., by passing behind the planet; and between 10 P.M. and 11 P.M. the largest will disappear by coming in front of the planet. On June 26, Jupiter will be seen when it rises, with all four moons; but a little after 10 P.M. the first will disappear by the planet passing between us and the moon and hiding its light; this satellite will reappear in 2h. and 24m.; and for a little over an hour the four moons are still seen. But the 3d or largest is very near the planet, and a little after 2 A.M. comes in front of and is lost in the light of Jupiter. The small stars around Jupiter are those of the constellation *Sagittarius*.

Saturn.

Saturn rises on June 1 at 1h. 5m. A.M., and sets at 0h. 23m. P.M. On the 30th, Saturn rises at 11h. 10m. P.M., and sets at 10h. 29m. A.M. of the next day.

Mars and Saturn rise at nearly the same time on the 30th, but Saturn is 5° further north.

Uranus.

On the 1st, Uranus rises at 9h. 57m. A.M., and sets at 11h. 49m. P.M. On the 30th, Uranus rises at 8h. 9m. A.M., and sets at 9h. 57m. P.M. Uranus is still among the stars of *Leo*.

Sun Spots.

The report is from April 17 to May 16 inclusive. In the photograph of April 17, there appears on the western limb the group of large spots mentioned in the last report; but from this date to April 21 clouds prevented observations, and during that time the group disappeared. On April 21, a pair of small spots was seen far advanced on the eastern limb. On April 22, this pair was followed by a pair of very small ones. During the passage across the disk, there was a continual change in the number and arrangement of the spots in these two groups. Before April 30, both had disappeared. In the picture of this date, a small group was seen on the eastern limb; but after May 5 it could not be found. When last seen, it was near the center of its course, but very faint. The observation of May 5 showed a small spot, followed by a very faint one. On May 4, these spots had not been seen, and were first visible on the western limb. On May 8, a large spot was seen coming on. From May 8 to May 12, no observation could be made. On May 12, two large spots were seen near the center; one of these was seen before May 8, the other had burst out between May 8 and May 12. The one first seen on May 8 disappeared between May 13 and May 14 at about the center of its course; the other is still visible (May 16), and is at present preceded by a small spot not seen on May 15.

GRANT'S IMPROVED HORSE HAY FORK.

We illustrate herewith a new and ingenious apparatus for unloading hay and like material by means of horse power. The advantages claimed are simplicity and strength, and the adaptability of the device to unloading barley or any like substance, either long or short, ordinarily difficult to handle by appliances of this kind. Fig. 1 is an exterior view, and

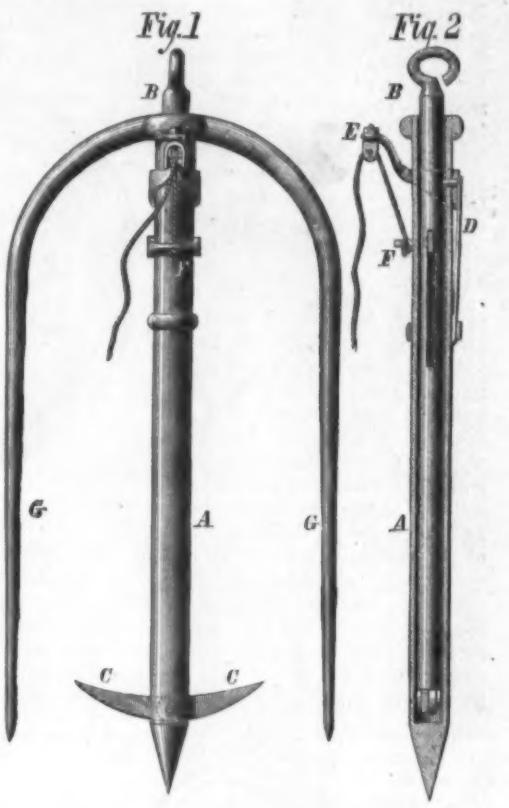


Fig. 2 exhibits a section of the central tubular tine, A. Into this tine fits a tubular plunger, B, which is provided at its upper end with a hook, and is plugged at its lower extremity, where are affixed ears to which the barbs, C, are pivoted. The spring, D, is clamped to the tine by a band and screw, and has a catch pin which passes through the disengaging lever, E, and the side of the tine, and enters a hole in the plunger, B. The lever, E, encircles the tine, and rests under the spring, and is held in place by the catch pin. The end of this lever is bent upward, and is provided with a small pulley. At F, is a key, which passes through a mortise in the tine and through a slot in the plunger, thus serving to limit the motion of the latter. The end of the key is bent over the front of the tine, and is formed into an eye, to which the disengaging cord, which passes upward over the pulley, is attached. At G are lateral tines, which are detachably secured to the central tine, so that, when a light fork is desired, the latter may be used alone.

In using the apparatus, the plunger, B, is drawn upward until caught by the catch pin. In this position, the barbs, C, are retracted. The fork is then lowered into the hay or grain until well buried. The lever cord is then pulled, when the catch pin is withdrawn from the plunger and the latter descends, throwing out the barbs. These as they extend press and pack the material up into the crotchets of the tines. In this position, the plunger is again caught by the catch pin; and as the bottom of said plunger rests on the barbs, the weight thereon is taken off their pivots and brought to bear on the key, F. The load is then lifted. When it is to be discharged, the lever is again moved, the catch pin withdrawn, and the weight causes the fork to descend, the plunger remaining stationary. This causes the retraction of the barbs and consequent release of the hay. The invention received an award and commendatory report at the Centennial Exposition.

Patented through the Scientific American Patent Agency, April 3, 1877. For further information relative to sale of territory, etc., address Peter Grant, Clinton, Ontario, Canada.

A Large Passenger Steamer.

The new steamboat, the Massachusetts, of the New York and Providence line, was built by Mr. Steers, of Greenpoint, N. Y. Her dimensions are as follows: Length, 325 feet; beam, 46 feet; beam, over all, 76 feet; depth of hold, 16 feet 4 inches. The frames are of white oak and locust and cedar, the floor timbers of white oak, and the top timbers of locust and cedar. The deck is of white pine. The launching weight of the Massachusetts, without the machinery or joiner work, was 1,000 tons. The engine is of the vertical beam type, with all the recent improvements. There is a 90-inch cylinder with a stroke of 14 feet. The wheels measure 39 feet 7 inches in diameter. There are two smoke pipes. The boat will be steered by steam. The interior arrangements are very handsome.

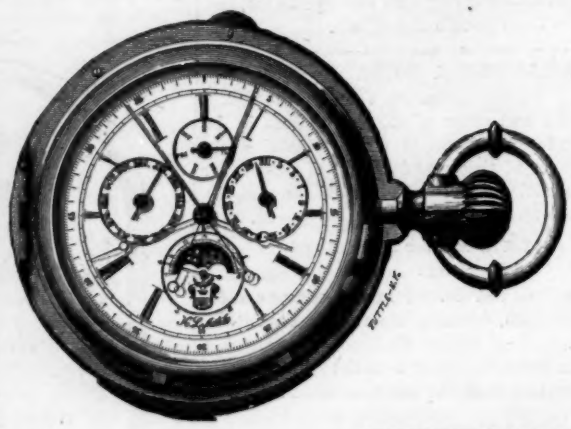
THE dreaded *hemileia vastatrix*, which has hitherto been confined to coffee plantations of Ceylon and Southern India, has at last made its appearance in Sumatra, and in all probability will find its way before long to the neighboring islands where coffee is grown.

A WONDERFUL WATCH.

In the accompanying engravings we present the remarkable watch which that able scientist, Mr. Mark Twain, says "knows considerably more than the average voter," and "comes nearer to being a human being than any piece of mechanism I ever saw before." Mr. Twain probably did not have in his mind the modern reaper, which picks up grain, makes it up in bundles, cords it, and ties a knot in the cord, or the Jacquard loom, which weaves portraits, or the talking machine, or the perfecting Hoe and Walter printing presses, all of which are very much more human-like in their performances than this watch, when he ventured the above opinion; so that we cannot fully indorse his thoughtful remark, but it is none the less true that the timepiece is an exceedingly ingenious specimen of horological skill.

We are not going to explain the machinery, because we want to print something else in this issue, and our readers might not enjoy reading about nothing but this watch, as would be the case if we described it in detail. Therefore we give several beautiful engravings of the works, and a general description of what they accomplish.

Fig. 1.



MATILE'S WATCH.

In Fig. 1 is given a view of the face of the timepiece, showing four small dials. There is of course, first, the usual dial for noting the time. Beside the two hands necessary for the latter purpose, are two long hands which point to a graduated scale which, divided in 60 parts and subdivided to fifths of a part, surrounds the circumference of the dial. These two hands normally both point to twelve. Suppose we are timing two horses starting

Fig. 3.

at different times. The instant the first horse is off, we press a stop on the side; then hand No. 1 starts marking seconds. When the second horse starts, we press the stop again, and hand No. 2 begins its movement in the same direction. At any desired moment the stop is pressed a third time, and

Fig. 4.

both hands are instantly arrested. Finally a fourth pressure on the stop sends the two hands back to twelve. Just under the XII mark is a small dial which shows the day of the week; another dial on the right exhibits the day of the month, another on the left the name of the month, the fourth below has a hand which beats fifths of seconds, and also an open face through which a golden moon on a blue enameled sky can be seen. This moon follows exactly the phases of our satellite; so that the time of new or full moon is instantly seen. The moon besides has a stop of her own, so that she can be set a day or more ahead in adjusting the watch, and another stop serves to regulate the month and day dials. The watch, besides, is a repeater; and on pressing still another stop, it sounds first the hour, then a certain number of times to indicate the quarter, half, or three quarters past, and then the requisite number of separate strokes to tell the minutes elapsed since the quarter. Leap year and February 29 are fully provided for. There is a little wheel, D, Fig. 2, which makes one quarter revolution per year. In four years it completes its turn, and the hand on the February mark of the month dial stays there for one day longer.

Fig. 2 represents the works just beneath the dial plate. A is the wheel for the month hand, B that for the date hand, C that for the week day hand, and E is the moon wheel. Underneath this mechanism, the machinery looks as represented in Fig. 3. The principal portion of the works that operate the repeater device is here. On turning the watch over and opening the back, intricate mechanism is shown, as in Fig. 4, which exhibits the annular bells, the hammers, and the double winding apparatus.

M. H. L. Matile, of Locle, Switzerland, made this remarkable timepiece, and exhibited it at the Centennial. The mechanism is so perfectly and accurately executed that it requires comparatively little power to be exercised by the main train to accomplish all this work, and this without interfering with the notation of exact time. It should be mentioned that a first-class rating and certificate from the observatory of Neufchatel accompanies the watch, setting forth its surprisingly accurate running qualities. We are indebted to Messrs. Mathey, of 119 Fulton street, this city, for our information.

Fig. 2.

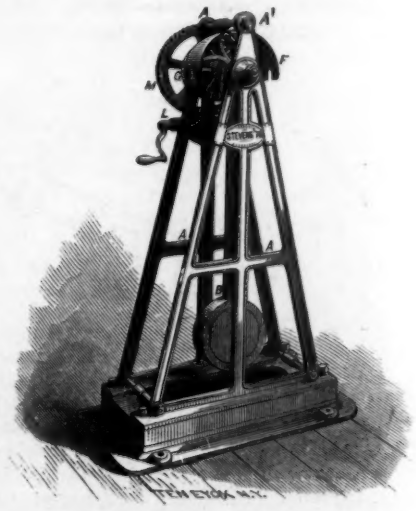
Where to Buy Sportsmen's Tackle, etc.

Mr. W. Holberton, dealer in sportsmen's goods, of 102 Nassau street, this city, has issued a neat little illustrated pamphlet, giving full descriptions of all the novel and ingenious inventions which increase the comforts and lessen the hard work incident to camping out. Particulars are also given relative to the best guns and fishing tackle, and of the numberless appliances which go to make a sportsman's outfit complete. What with portable stoves, portable tents, portable boats, and portable beds, life in the woods need now involve few of the hardships which go to alloy its pleasures; while if the modern hunter grows in destructiveness with the multitudinous devices, invented for his benefit and here illustrated, certainly more piscicultural societies and more game law makers will find renewed fields for their endeavors. We cannot particularize as to the best things noted in Mr. Holberton's catalogue, although there is one "fly book" which will especially commend itself to anglers, and is, we think, one of the best arranged books we have ever seen. A full description is given of the new glass ball trap for pigeon shooters, which is an excellent apparatus, which we —and Mr. Bergh we are sure will cordially join us—can commend to the notice of amateur shots. Persons dealing with Mr. Holberton have the satisfaction of knowing that his advice as to flies, etc., can be relied upon, as he is a practical sportsman himself. The price of the pamphlet is 10 cents.

PROFESSOR R. H. THURSTON'S AUTOGRAPHIC TESTING MACHINE.

We illustrate herewith the latest and most complete form of Professor Thurston's machine for testing the strength, elasticity, ductility, shock-resisting power or resilience, and the homogeneousness of metal. The material is tested by twisting, by which is obtained a great range of distortion, and the most favorable treatment for revealing all the characteristics of the test piece. The latter is placed between two independent jaws, one of which is rotated by means of an arm in the simpler styles, and in the one here illustrated by a worm, L, and gear, M. The force thus applied is transmitted through the test piece to the other jaw, from which depends a weighted arm or pendulum, B. The resistance offered by this pendulum to the force tending to deflect it from the perpendicular, causes that force to react upon the test piece and produce distortion and fracture. The angular position assumed by the pendulum is a measure of that force. A pencil is secured to the pendulum and is moved when the latter is thrust forward in a direction perpendicular to the plane of rotation, by its contact with a guide curve, F, fastened to the frame of the machine. A cylinder, G, is secured to that jaw which is moved by the gear wheel. The cylinder and the pencil have precisely the relative movements of the two ends of the test piece, so that the length of the curve, automatically described by the pencil upon a paper wrapped about the cylinder, becomes a measure of the degree of distortion or of the ductility, and its height measures the resistance offered by the material. The material thus tells its own story, these elements recording themselves simultaneously and continuously from the initial point to the point of final rupture. The diagrams made by the machine show to the eye at a glance the nature of the material tested, and are very characteristic. The strength of the material is measured on the diagram with a pocket rule or a pair of dividers. Any bright boy can make the tests and interpret the diagrams.

These machines offer facilities for a study of the physical properties of the materials of construction, and of the manner in which molecular changes are induced by the various processes of manufacture and of use. They are in constant use for the tests and researches carried on in the Mechanical Laboratory of the Stevens Institute of Technology, and have been supplied to the United States Navy Yard at Washington, to the Russian and Japanese Governments, and to some of our leading railroads, iron manufacturers, and scientific institutions. The apparatus is especially valuable in testing such metals as cast iron, as it measures extensions which other machines cannot detect to the hundred millionth of an inch. It has been used with success in testing car wheel irons, showing their relative value with accuracy. The purchaser of the machine is supplied with tables by which he obtains accurately the percentages of elongation, and with instructions giving the methods of deducing the strength, elasticity, homogeneousness, and other qualities.



The machine illustrated was designed and made entirely by the students of the class of 1876 of the Stevens Institute of Technology, and was exhibited by them at the Centennial Exhibition. It received the award of the judges. The earlier forms received the gold medal, the highest award at the Exhibition of the American Institute, 1874 and 1875, and the medal of the Cincinnati Exhibition of 1875. The machine is manufactured in the workshop of the Mechanical Laboratory of the Stevens Institute of Technology, Hoboken, N. J., and by Messrs. William H. Bailey & Co., of Salford, near Manchester, England.

The Speaking Telephone in New York.

Professor A. Graham Bell recently exhibited his telephone at Chickering Hall, in this city. Wire communication was established with New Brunswick, N. J., a distance of 32 miles. The lecturer in his first discourse explained the laws of sound, and afterwards the members of the audience were afforded opportunities to converse with Mr. Watson at the other end of the line. Small instruments were used, and the sound produced was not generally audible throughout the hall.

Fall of a Court House.

A new court house, nearly completed in Rockford, Ill., recently fell down, killing ten men and wounding fourteen. The dome was 119 feet from the ground, and was supported by iron columns, which in turn rested on a brick wall. The latter was not constructed of sufficient strength to hold up the superincumbent weight. It accordingly gave way, and was followed by the entire dome and roof, leaving little more than the four walls of the edifice standing.

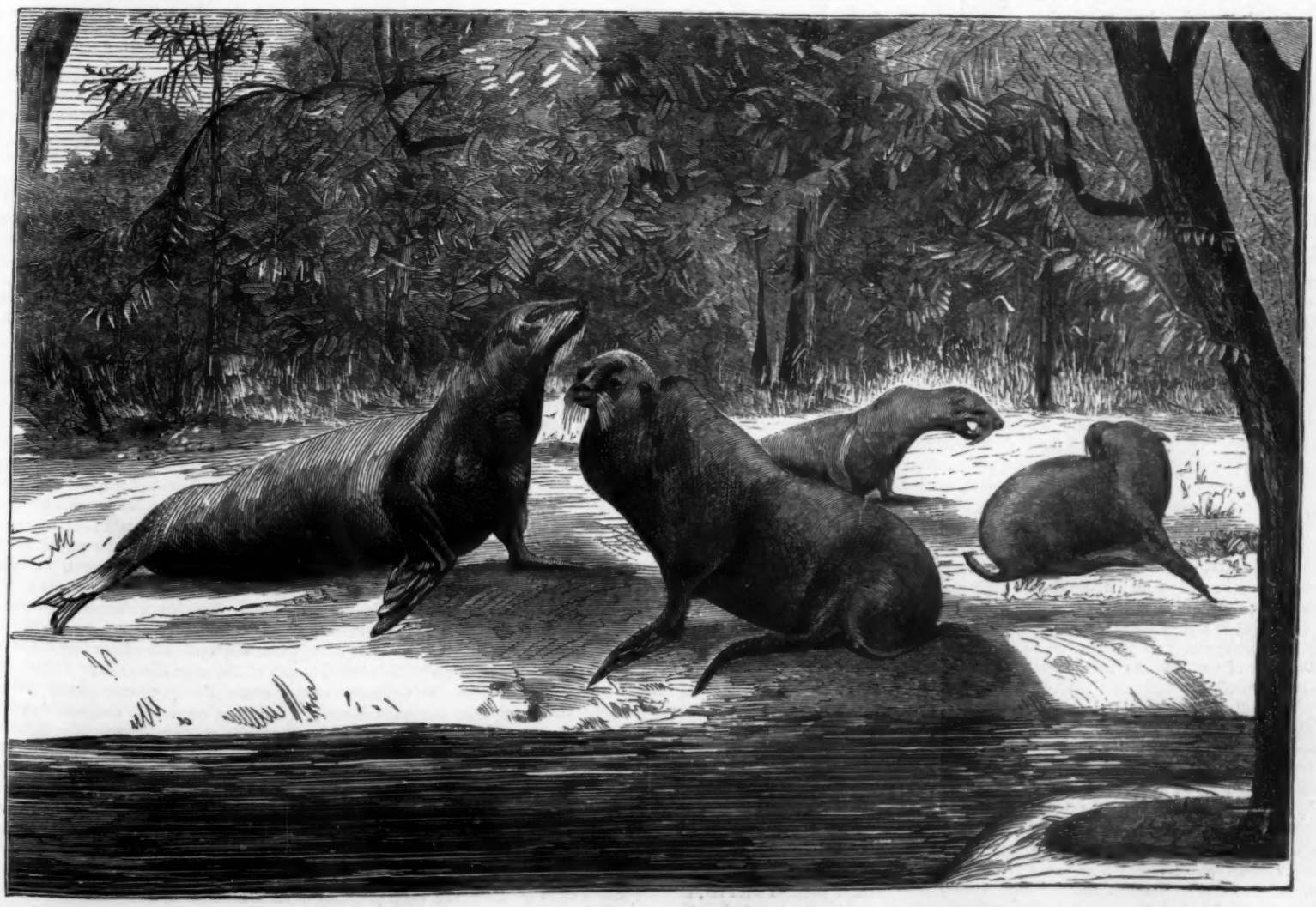
THE FOUNTAINS AT ARANJUEZ.

About thirty miles to the south of Madrid, the capital of Spain, lies a princely domain surrounding a magnificent country mansion. This is Aranjuez, the summer residence of the King. It was designed and constructed under the directions of Philip the Second, and is reached by a well constructed road connecting it with the capital, as well as by the Madrid and Alicante railway. The palace of Aranjuez contains many noble works of art; but the chief attraction to natives as well as visitors is the park, with its ornamental gardens and fountains. Our engraving represents the Triton fountain, which stands in a shady and secluded spot. The arrangement of the water jets and of the bronze and marble sculpture is exceedingly artistic and effective. Broad double avenues of elms traverse the park, leading to the center; and the walks are lined with box and laurel hedges. The purple buds of the cactus and aloe stand out against the green of the rare shrubs; and the air is filled with the fragrance of the orange blossom.

THE TRITON FOUNTAIN IN THE PARK AT ARANJUEZ.

CALIFORNIAN SEA LIONS.

Of the family of *phocidæ* or seals, the *otariæ*, comprising the so-called sea lions and sea bears, are especially interesting. Like most members of the seal family, they are easily tamed, and are affectionate and docile; they can be taught to sit up, to bow, to kiss the hand, and to perform many tricks. Many of our readers have probably seen the southern sea lions (*otaria jubata*) in the Zoölogical Gardens in London, and also the northern or California sea lions (*otaria Stelleri*) in the Thiergarten at Hamburgh, Germany. The sea lions in Central Park, and at the Aquarium in this city, are of the latter species; and the intelligence and affection for their keepers which they manifest, and their efforts to raise themselves out of the tanks of water in which they are kept, in order to reach their master, are very amusing. Our illustration shows the specimens in the Hamburgh collection above mentioned, the animals being quite young. The males of this genus are about 5 feet long when fully grown, and the females about 4 feet. They yield fur of a golden brown color. Their ears are small, pointed, and pendent, and their eyes are large, full, and expressive. The jaws display, when open, formidable teeth. Their snouts are furnished with long drooping, silver-white bristles. They are found along the coasts on the Northern Pacific Ocean, from Behring's Straits to California and to Japan, and are hunted for their fur, as well as for their flesh, which is a favorite article of diet in the Aleutian Islands. Our readers will at once notice the comparative smallness of the heads and length of the necks, the latter being elongated at will. The prominence of the shoulder blades gives them a hump-backed appearance. They are much more agile than would be supposed from their size and weight, and they move lightly and gracefully through the water. Their bodies are very flexible, and they can scratch their heads, as dogs do, with their hind paws. Their bellowing can be heard at a great distance, and the males are fond of exhibiting their vocal powers; the sound is disagreeable, resembling the cry of a child in distress, although, of course, it is much louder.



CALIFORNIA SEA LIONS IN THE HAMBURGH ZOOLOGICAL GARDENS.

In a recent lecture on heat, delivered at the Royal Institution, Professor Tyndall described an invention of Mr. Siemens to detect the oxidation of telegraph cables. It indicates the heat that the oxidation occasions, and thus shows to what extent the rust is forming. It is chiefly of service with cables coiled in tanks.

The Destruction of the Young Locusts.

The Commissioners selected by Congress to investigate and report on the best means of destroying and preventing the ravages of the locusts have issued their first "Bulletin," under the auspices of the Interior Department. With gentlemen of such ability as compose this Commission, our agriculturists may have reasonable hopes that a remedy may be found for relieving them of the obnoxious and destructive enemy of their crops. The present number has exclusive reference to the destruction of the young insects which will so largely, the Commissioners state, occupy the attention of our Western farmers for the next two months. It is to be followed by a second number, on the natural history and habits of the species. The report says:

"The only feasible way of now destroying these is to plow them deeply under where that is possible. The plowing will be effectual according as the soil is porous or tenacious, and according as the surface is afterward compressed by harrowing and rolling. All other things being equal, a plowing of 4 to 6 inches will prove more effectual, if the ground be subsequently harrowed and rolled, than deeper plowing with no subsequent comminution and compression. We advise the farmers in the locust region to supply themselves with early ripening seed corn, and to prepare to grow more leguminous and tuberous crops than is the custom. But as the principal struggle during the next two months will be with the young insects, we devote this bulletin more particularly to the best means of overcoming them. Heavy rolling, where the surface of the soil is sufficiently firm and even, destroys a large number of these newly hatched young, but is most advantageously employed when they are most sluggish and inclined to huddle together, as during the first eight or ten days after hatching, and in the mornings and evenings subsequently. They then drive almost as readily as sheep, and may be burned in large quantities by being driven into windrows or piles of burning hay or straw. They may also be killed with kerosene, and by means of flattened beating implements, wooden shovels being extensively used for this purpose in Europe. But to protect the crops and do battle to these young locust armies, especially where, as was the case in much of the ravaged country in 1875, there is little or no hay or straw to burn, the best method is ditching. A ditch 2 feet wide and 2 feet deep, with perpendicular sides, offers an effectual barrier to the young insects. They tumble into it and accumulate, and die at the bottom in large quantities. In a few days the stench becomes great, and necessitates the covering up of the mass. In order to keep the main ditch open, therefore, it is best to dig pits or deeper side ditches at short intervals, into which the 'hoppers will accumulate and may be buried. Made around a field about hatching time, few 'hoppers will get into that field till they acquire wings, and by that time the principal danger is over, and the insects are fast disappearing. If any should hatch within the inclosure, they are easily driven into the ditches dug in different parts of the field. The direction of the apprehended approach of the insects being known from their hatching locality, ditching one or two sides next to such locality is generally sufficient, and when farmers join they can construct a long ditch which will protect many farms. We have not a doubt but that with proper and systematic ditching, early in the season, when the insects first hatch, nearly everything can be saved. Where water can be let into the ditches so as to cover the bottom, they may be made shallower, and still be effective. A ditch 3 feet wide, unless correspondingly deep, will be more apt to permit the escape of the insects when once in than a narrower one. In hopping, the more perpendicular the direction the insects must take, the shorter will be the distance reached. Of course, the wider the ditch, if it be correspondingly deep, the more effectual will it prove. In exceptional cases, when the locusts are nearly full grown and the wind is high, so as to assist them, even the two feet ditch loses much of its value.

"Next to ditching, the use of nets or seines, or converging strips of calico, or any other material, made after the plan of a quail net, has proved most satisfactory. By digging a pit, or boring a post auger hole 3 or 4 feet deep, and then staking the two wings so that they converge toward it, large numbers of the locusts may be driven into the pit after the dew is off the ground. By changing the position of this trap, much good can be done when the insects are yet small and huddled in schools. But all modes of bagging, netting, crushing with the spade or other flat implements, and burning, which can be employed to good advantage when the insects first begin to hatch, become comparatively useless when they begin to travel in concert over wide stretches of land. The same may be said of all the mechanical contrivances to facilitate the destruction of the insects; they are useful if used in concert in a given neighborhood soon after the young hatch, but subsequently do not compare to ditching. There are a number of contrivances that have been more or less successfully used, but we cannot treat of all of them in detail. We shall, rather, at this time, content ourselves with descriptions of a few, which will illustrate the principles to be kept in view. Those used in Minnesota, so far as we can learn, are applications of one principle, namely, an open-mouthed bag, dragged by hand or horse power. We have seen a very large one that would take from eight to twelve bushels of pupæ per day; but this was after the insects had been pretty effectually fought by burning and otherwise. It was very effective. Its owner proposes to place his whole dependence on it next year. It had one addition over others that we think valuable. It ran back 10 feet or more to a bag, and near the rear end two or three square feet of cloth had been cut out and replaced by wire gauze. This gave a chance for the air to draw through, and as the locusts worked toward the rear end they made toward the light shining through the wire. This machine was rigged on cart wheels, and the only expense was in getting three long poles from the woods, and in purchasing about forty yards of cotton muslin.

"Major J. G. Thompson, of Garden City, Minn., has used with satisfaction a net made as follows:

"'Two pieces of common batten about 16 feet long were used as framework for the mouth of the net, one for the bottom and one for the top. From the end of the bottom piece a wooden shoe of the same material ran back about 6 feet to steady the trap and serve as a runner. To the rear end of this shoe a similar piece was fastened by a hinge, and ran forward and was fastened to the top piece of the frame, so that the mouth of the trap would open and shut like a jaw. To hold the mouth open, two short upright posts were fastened to the top piece by a hinge, and rested upright upon the bedpiece. The net itself was made of cotton cloth for the bottom, and the top was made of mosquito netting. The mouth of the net extended 16 feet from one side of the trap to the other, and the net ran back about 6 feet to a point with a hole at the end to let out the insects collected. A boy ten years old can draw one end of this net, and by the use of it Major Thompson saved one piece of wheat.'

"Similar machines have been drawn by horses hitched to each side of the trap, being 12 to 16 feet apart. The horses serve the purpose of driving the locusts inward toward the mouth of the net. There have been many forms of these machines, but all on the same general principle. In Colorado, also, machines have been used to good advantage, most of them having for their object the burning of the young insects. Mr. J. Hetzel, of Longmont, uses a burner drawn by horses. It is 12 feet long, 2 to 2½ feet wide, and made of iron, set on runners 4 inches high. An open grate on the top of the runners is filled with pitch pine wood, and a sheet covers the grate to keep the heat down. The grate is generally made with a network of heavy wire, such as telegraph wire. Two men and a team will burn 10 to 12 acres a day, and kill two thirds of the insects, but it requires a hot fire. Mr. C. C. Horner gives in the *Colorado Farmer* the following more detailed description of a machine which works on the same principle:

"'It consists of three runners made of 2x4 scantling 3 feet in length, to be placed 6 feet apart, making the machine 12 feet wide, runners to be bound together by two flat straps or bars of iron (the base being 12 feet long). Across the top, bars of iron hold the runners firmly together and form a frame across which wire can be worked, to make a grate to hold fire. The upper part of the runners should be hollowed out so that the grate may glide along within 2 inches of the ground. A sheet iron arch should be set over this grate to drive the heat downward. This machine is very light, and can be worked with one horse. Pitchwood is best adapted to burning, and can be chopped the right length and size and left in piles where most convenient when needed. This machine is intended to be used when the little 'hoppers just make their appearance along the edge of the grain, going over the ground once or twice each day, or as often as necessary to keep them killed off. The scorching does not kill the grain, but makes it a few days later. This is certainly the cheapest manner of getting rid of this pest, as well as the most effectual.'

"Mr. Rufus Clark, of Denver, according to the same paper, uses a piece of oilcloth 9 to 12 feet long and 6 feet wide. One side and each end are secured to light wooden strips by common carpet tacks, and the corners strengthened by braces. The oilcloth is smeared with coal tar, purchased at the Denver gas works at $7.50 per barrel, and the trap is dragged over the ground by two men, a cord about 10 feet long being fastened to the front corners for that purpose. The entire expense of the 'trap' is about $3.50; and as it is light and easily handled, it will be found serviceable on small as well as large farms. Zinc, instead of oilcloth, has also been used for the same purpose. When the insects are famishing, it is useless to try and protect plants by any application whatever, though spraying them with a mixture of kerosene and warm water is the best protection we have tried, and will measurably answer when the insects are not too numerous or ravenous.

"The best means of protecting fruit and shade trees deserve separate consideration. Where the trunks are smooth and perpendicular they may be protected by whitewashing. The lime crumbles under the feet of the insects as they attempt to climb, and prevents their getting up. By their persistent efforts, however, they gradually wear off the lime and reach a higher point each day, so that the whitewashing must be often repeated. Trees with short, rough trunks, or which lean, are not very well protected in this way. A strip of smooth, bright tin answers even better for the same purpose. A strip 3 or 4 inches wide brought around and tacked to a smooth tree will protect it, while on rougher trees a piece of old rope may first be tacked around the tree and the tin tacked to it, so as to leave a portion both above and below. Passages between the tin and rope or the rope and tree can then be blocked by filling the upper area between tin and tree with earth. The tin must be high enough from the ground to prevent the 'hoppers from jumping from the latter beyond it; and the trunk below the tin, where the insects collect, should be covered with some greasy or poisonous substances to prevent girdling. This is more especially necessary with small trees, and kerosene or whitewash having Paris green mixed with it will answer as such preventives. One of the cheapest and simplest modes is to encircle the tree with cotton batting, in which the insects will entangle their feet, and thus be more or less obstructed. Strips of paper covered with tar, stiff paper tied on so as to slope roof fashion, strips of glazed wall paper, and thick coatings of soft soap, have been used with varying success; but no equal the bright tin. The others require constant watching and renewal, and in all cases coming under our observation some insects would get into the trees, so as to require the daily shaking of these morning and evening. This will sometimes have to be done, when the bulk of the insects have become fledged, even where tin is used, for a certain proportion of the insects will then fly into the trees. They do most damage during the night, and care should be had that the trees be unloaded of their voracious freight just before dark. Most cultivated plants may be measurably protected from the ravages of these young by good cultivation and a constant stirring of the soil. The young have an antipathy to a loose and friable surface, which incommodes them and hinders their progress, and they will often leave such a surface for one more hard and firm. Finally, though insisting on ditching and the digging of pits, as, all things considered, the best and most reliable insurance against the ravages of the young locusts, we would urge our farmers to rely not on these means alone, but to employ all the other means recommended, according as convenience and opportunity suggest. Another method of destroying the young has been proposed and to a certain extent adopted. It promises, if carried out effectually, to be of much advantage. It is to protect the prairie grass from fires until spring, and, after the bulk of the eggs are hatched, to simultaneously burn over the entire neighborhood, township, or county, or as far as the combination may extend. This requires concerted action and considerable watchfulness, but if carried out rigidly will destroy a very large number of insects, and has the advantage of being inexpensive. It is inapplicable on the cultivated grounds, but applies to the areas where the other measures are least effective.

"One of the most effectual means of destroying the young locusts, and one which is too often overlooked because its effects are not so directly apparent, is the preservation and multiplication of the native birds. Without undertaking at this time to specify the species which should be especially protected, and about which there is yet some difference of opinion, we feel warranted in stating that until the useless species in this respect are distinguished from those that are beneficial, it is best to protect all insect-eating birds; and if the laws of the State are insufficient for this purpose, let communities, townships, and counties use all their lawful powers therefor. Chickens, turkeys, and hogs devour locusts in immense quantities, and thrive during years of locust invasion or whenever these insects abound. Prairie chickens and quails devour them with avidity, and even hunt for their eggs; swallows and blackbirds pursue them unrelentingly; the little snow birds devour great quantities of eggs when these are brought to the surface by the freezing and thawing of the ground, and the same may be said of almost all birds inhabiting the western country in winter. The good offices of birds were everywhere noticed in 1875. Professor F. H. Snow, of Lawrence, Kan., found the young locusts in the gizzards of the red-headed woodpecker (*melanerpes erythrocephalus*), yellow-billed cuckoo (*coccyzus Americanus*), cat bird (*mimus Carolinensis*), red-eyed vireo (*vireo olivaceus*), great-crested fly-catcher (*myiarchus crinitus*), and crow blackbird (*quiscalus versicolor*), species that had not been noticed to feed on them before. The shrike or butcher bird impales them on to thorns and other pointed substances; and a number of other birds, as well as reptiles, such as toads, frogs, and snakes, feed upon them. We therefore strongly recommend the raising of as large a number as possible of hogs and poultry, both as a means of utilizing and of destroying the young locusts."

The States of Missouri, Kansas, and Minnesota have passed laws granting bounties for capturing and destroying, or otherwise preventing the increase and ravages of the grasshopper.

The Effect of Tobacco on the Human System.

In the fourth annual report of the Michigan State Board of Health, Dr. Scott relates something new in the influence of tobacco on the human system, as follows:

"There has come under my notice for several years, but more particularly during the last two years, a kind of rheumatic condition of the walls of the chest. The patient complains of a dull heavy pain in the chest walls. The disease in a large majority of cases is confined to the left side. The pain is circumscribed and limited to a space of not more than two inches in diameter, just below and a little to the left of the left nipple. At times the pain is very severe, and always constant day and night, when the patient is awake. I have investigated the disease to some extent, and find it to be more common among tobacco users, especially those who use the weed to excess. Patients suffering from this complaint invariably come to their physician with the belief that they have heart trouble. I have not found signs of organic lesion in any of the cases that I have examined, but there does exist in some of them what might be called 'irritable heart.' I am convinced that the greater number of these cases are the result of intemperance either in the use of tobacco or other stimulants, for the reason that, when the patient abstains from the use of them for a short time, his pain ceases and his condition improves. In one case, where the patient abstained from the use of tobacco for thirteen months, the pain entirely ceased; but at the end of this period the gentleman recommenced the use of tobacco, and after three weeks' use the old pain returned with all its severity. I am certain that quite a number in this vicinity are receiving treatment for heart disease, when, if they would reform in tobacco using, they would speedily recover."

NEW YORK ACADEMY OF SCIENCES.

The chemical section of the Academy of Sciences held their regular monthly meeting at 64 Madison avenue, Monday evening, May 14, 1877, Dr. J. S. Newberry, President, in the chair.

Mr. Henry Newton, E.M., exhibited some plates illustrating the palæontology of the Black Hills. The President spoke of the failure on the part of Congress to appropriate sufficient funds to pay the cost of their publication, thus throwing much of the expense of this very useful and practical survey upon Mr. Newton and his colleagues. Mr. Newton will soon return to the Black Hills to finish the survey begun by him and Mr. W. P. Jenney last season.

Mr. C. Chamberlain exhibited a specimen of the new mineral—astrophyllite—from El Pasoz county, Colorado. This mineral contains 13 ingredients, including titanium, tantalum, copper, etc. It is micaceous, but the laminæ are not flexible; it is of a yellowish color, and in powder looks like Mosaic gold. Also specimens of analcite with apophyllite, from Lake Superior.

The first paper of the evening was entitled

THE RELATION BETWEEN MALARIA AND VEGETATION,

as shown in the vicinity of New York, by General Egbert L. Viele. The speaker began by stating that in his plan of Central Park, which he made twenty years ago, he made a botanical garden one of the features of the Park. It was thrown out then, but now it is proposed to do what he then proposed. He next spoke of the drainage of the city, and exhibited a map showing the ancient watercourses. Many of these streams, he said, were supplied from perpetual springs, which will continue to flow until the end of time, yet no provision has been made to carry off the water of these springs; the city is absolutely without drainage. He had hoped that a botanical garden in the Park would develop certain plants that have the power of neutralizing the injurious effects arising from want of drainage. At that time 70,000 species of flowers and trees were growing in the Park, most of them being kept browsed down to 6 inches or a foot. The relation between plants and animals was next referred to; and much credit given to the researches of Tyndall, Huxley, Darwin, Pasteur, Bastian, and Hæckel. The opposite views of these investigators had promoted research and had been of great benefit, but much still remains unknown. The microscopist knows how close is the resemblance of plants to animals in the lower forms of life, how they seem to pass from one to the other. In higher forms of life, the refuse of one is the food of the other, so that they mutually sustain each other. An equilibrium of the two is a necessity for a wholesome state of the atmosphere. The tendency of civilization and the gravitation of people together into large cities is upsetting the equilibrium of natural forces. There is not enough vegetable life here to consume the refuse of the animal life. What are these surplus elements? They are everything that is offensive to any of the senses, whether in air, earth or water, indoors or out of doors, by day or by night. One of the results of this surplus of animal refuse is malaria. It has been established that there are present everywhere certain destructive principles which may at times and under favorable circumstances develop into malaria. We owe this word *mal aria* to the Romans, and it meant with them "bad air," which is recognized the world over as the cause of disease. The Greeks called it *miasma*, and built temples to Æsculapius to void off its evils. We wonder at their idolatry and ignorance, but our own ignorance is almost as great in regard to its true character. Malaria implies bad air; miasm, infection floating in the air. Under what circumstances does air become an agent in propagating such diseases as plague, cholera, yellow fever, and smallpox, which have destroyed millions, and are still at their deadly work? The speaker then spoke of the usual classification of diseases for statistical purposes, under "malarial," "zymotic," etc., in which malarial embraces all those which distinguish one country from another, one year from another, and which have at times decimated cities and countries. He stated that three fifths of all the deaths in the world result from miasmatic diseases. These have gone on from age to age almost unchecked and unrestrained, the average death rate increasing. He then spoke of the plague, cholera, smallpox, yellow fever, and their ravages in historical times; and said that an erroneous impression prevailed that malarial diseases are restricted to intermittent fever, chills, and fever and ague, which prevail wherever drainage is defective or the soil has been disturbed. People think that these fevers are never fatal, and come to think of malaria as something we can endure and become accustomed to. There were 30,000 deaths in this city last year, more than half of which were due to malarial diseases. He next referred to the three chief theories held by physicians in regard to malarial diseases; first, the gaseous theory, that they are due to certain gases; secondly, the vegetable theory, that they are due to germs; thirdly, the specific poison theory. Malaria has a history, a geology, a botany, a chemistry, a topography, a geography; yet all these have failed to explain it. It is hoped that the new science of biology will do more for it. Many of these diseases attack a person but once, and are contagious; a certain time elapses between exposure and the development of the disease. They generally run a certain length of time. These are called acute specific diseases. Could any gas do this? We know none with such power. The theory of specific poison only substitutes a general term and explains nothing, but only removes the question a step further. The vegetable theory is most worthy of study by biologists. The speaker exhibited a drawing of the *penicillium glaucus* magnified, also of a drop of blood from a patient that died within 48 hours with smallpox; the latter viewed under a microscope was as lively as a pond full of fish. The similarity of the two forms was quite remarkable.

Nearly the entire food of plants is derived from the air. It must be the refuse of the animal world, things which are hurtful to animal life. We all know that the country, where vegetable life predominates, is more healthy than the town. Tyndall has shown the presence of minute organisms in the air, and how they can be developed into larger forms. This island was, in its primitive state, a most beautiful place, and now how changed! Nature is for ever dethroned, the rivers are encroached upon and polluted, watercourses are cut off; the supersaturated soil gives off these germs of disease which make it as bad as the Roman Campagna. Central Park has become a mass of shrubbery through which no winds can blow, and is dotted with pools of stagnant water. Let this be remedied, and let botanists plant there those trees which are capable of consuming most of these poisons, and let our citizens aid to destroy the poison by the same means. The speaker concluded by pointing out on maps that, where fevers most abound, there have formerly been watercourses, and showed that the Roman fever was likewise brought about by the destruction of drainage systems and watercourses.

A somewhat spirited discussion followed, in which Dr. Newberry remarked that the *globulus* and the other species of *eucalyptus* known to us at present, are not sufficiently hardy to endure our climate, but expressed a hope that the mountainous portions of Tasmania might yet give us a more hardy species, or that those known may be gradually acclimatized to our latitude by beginning to cultivate them further south.

Mr. Alfred R. Conkling then read a very interesting paper on the

GEOLOGY OF LAKE TAHOE AND VICINITY,

illustrated by a large blackboard map. The region about this lake seems to be an exceedingly interesting one. On the east side, near Carson City, are several hot springs with water at temperatures of 111° Fah. to 120°. The formation is quarternary. There are several gold mines on the east side of the lake, in quartz and granite, and several shafts have been sunk. In some of these mines copper minerals are also found. At the northern end of the lake is a peak called Mount Rose, 1,082 feet high. There are two other outcrops of igneous rocks on the east summit, one of which is called Shakespeare's Cliff, from the grouping of lichens on one side, which resemble that famous dramatist. The other is called Cave Rock. The lake itself is 21 miles long, and 12 broad at the widest part. Its depth near the south end is 900 feet, and increases to 1,645 near the north end. The temperature of the water is 54° Fah. It lies 6,000 feet above the level of the sea. On the west side are mineral springs whose waters contain carbonic acid and sulpheretted hydrogen gases, and have a temperature of 46° Fah. They are bottled and sent to Carson City. On the same side are some ridges and peaks. Evidences of ancient glacials are abundant. One of of these old glaciers was equal to the Mer de Glace. The paths of several others are marked by morains. In the neighborhood are some small lakes, the basins of which may have been dug out by glaciers. At the southwestern side is a bed of graphite. Echo Lake, near by, is so called because there is no echo there. North of the lake is a hot spring, the water of which has a temperature of 132° Fah.

Dr. Newberry made a few remarks on this interesting phenomenon of a deep cold lake on the top of a mountain, and the probability of its being the result of glacial action.

Fly Paper.

Powdered black pepper is mixed with syrup to a thick paste, which is spread by means of a broad brush upon coarse blotting paper. Common brown syrup will answer, but syrup made from sugar is preferable, as it dries quicker. For use, a piece of this paper is laid upon a plate and dampened with water. The paper may also be made directly at the mill by adding sugar to the pulp, and afterwards ¼ to ½ of powdered black pepper, and rapidly working it into a porous absorbent paper.

INTERNATIONAL POSTAL ORDER SYSTEM.

Since the system of interchange of our postal orders with those of foreign countries, persons abroad can remit small amounts to this country safely and without any trouble. It is a great convenience to the public to be able thus to transmit money, and to publishers it proves especially convenient.

In a letter before us, from Leeds, England, the writer states: "There appears some difficulty in getting your papers at reasonable prices in this country. We are at the mercy of news agents, who seem to charge what they like. I would suggest the advisability of your inserting the subscription price by post, as a means of increasing the circulation of the paper to a considerable extent, for it is increasing every day in the estimation of engineers and others." Now, had it occurred to our correspondent that he could readily have deposited his pounds or shillings with the postmaster at Leeds, to be transmitted to us, he would probably have done so, in place of scolding the news dealers; and likely there are many other intelligent foreigners who would like to have the SCIENTIFIC AMERICAN, but who do not know how to remit for it. So, in accordance with the suggestion of our correspondent, we annex a list of prices, in the currency of different countries, for the SCIENTIFIC AMERICAN, for the SCIENTIFIC AMERICAN SUPPLEMENT, and for both papers, as the subscriber may desire:

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Deposit either of the above amounts in any of the important post offices in Great Britain or Ireland, or in any country on the continent of Europe, making the order payable to MUNN & Co., New York city, and send us the receipt, with the name of the sender, and the address to which the paper is to be mailed.

NEW BOOKS AND PUBLICATIONS.

HOW TO TEACH ACCORDING TO TEMPERAMENT AND MENTAL DEVELOPMENT; or Phrenology in the School Room and the Family. By Nelson Sizar. Illustrated. Price $1.50. New York; S. R. Wells & Co., 737 Broadway.

Although physiologists generally believe that phrenology has not yet settled itself into a fixed science, its disciples invariably use its theories as mathematical axioms and undisputed facts. The many instances in which its teachings are nullified, by the fine skull development of many idiots and criminals, have done little to shake the faith of believers in the suggestions of Gall and Spurzheim; and as is usual in such cases, those celebrated craniologists would have been surprised to find their ideas (founded with apparent justification on the comparison of many heads) resolved into arguments as to the direction of the studies of youth. The volume before us attempts to do this; and it is illustrated by engravings of various types of heads, from which many people might deduce a theory that a man's errors and vices are due not to his immoral nature or his neglect of self-control, but to the shape of his head.

HOW TO RAISE FRUITS: a Handbook of Fruit Culture. By Thomas Gregg. Illustrated. Price $1.00. New York city: S. R. Wells & Co., 737 Broadway.

This little book is a thoroughly excellent and practical treatise; and it has our special commendation, not only on account of its valuable instruction to fruit growers, but for its convincing demonstration of the value of fruit, to the farmer as a source of a revenue, and to the consumer as an article of diet.

A HISTORY AND HANDBOOK OF PHOTOGRAPHY. Translated from the French of Gaston Tissandier. Edited by J. Thomson, F.R.G.S. New York city: Scovill Manufacturing Company, 419 to 421 Broome street.

M. Tissandier is the editor of our excellent contemporary *La Nature*, and one of the best French writers on popular scientific topics. In the present volume he has combined a history and a useful manual of the photographic art, the latter of which is excellently adapted for the purposes of the amateur. For general perusal, the work can be especially commended, as it gives in pleasant, readable style, a capital account not only of photography but of many of the new processes, for the mechanical reproduction of pictures, dependent on photographic manipulation. The subjects of photo-micrography and astronomical photography are fully discussed. The illustrations are numerous and remarkably good; and an appendix is added, giving many valuable practical recipes.

Inventions Patented in England by Americans.

From April 24 to April 30, 1877, inclusive.

CARRYING WEIGHTS.—J. E. Barlow, Sing Sing, N. Y.
CHEMICAL TELEGRAPH.—C. A. Randall *et al.*, New York city.
CONCENTRATING SULPHURIC ACID.—F. W. Kalbfleisch, Brooklyn, N. Y.
EMERY WHEEL.—I. P. Brown, Jr., Newark, N. J.
FEED WATER HEATER.—G. Steel, New York city.
HYDRAULIC LIFT, ETC.—H. R. Plimpton, Boston, Mass.
JOURNAL BOX AND BEARING.—W. B. Bishop, New York city.
LIFE BOAT.—G. Bates, Massachusetts.
MILLING MACHINERY, ETC.—T. D. Jones, Syracuse, N. Y.
PROPELLING VESSELS, ETC.—J. H. Carpenter, New York city.
RECORDING THERMOMETER, ETC.—R. K. Boyle, New York city.
REDUCING ORES, ETC.—C. M. Dupuy, Philadelphia, Pa.
REFRIGERATOR CAR.—J. M. Ayer, Chicago, Ill.
SHIP'S BERTH, ETC.—J. C. Thompson (of Brooklyn, N. Y.), London, Eng.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED COMBINED COTTON CHOPPER AND SCRAPER.

Empson C. L. Bridges, Brick Church, Tenn.—In this machine the frame to which the hoes or choppers are attached is vibrated by suitable gear connection with the transporting wheels, and the said vibrating frame can be raised and lowered by a crank shaft, and adjusted forward or back by a like adjustment of the sliding frame to which it is attached. The scraper, which goes in advance of the chopping mechanism, may be adjusted laterally by a treadle mechanism.

IMPROVED CAR COUPLING.

Edward B. Middleton, Charleston, S. C.—This coupling is composed of a hook fixed on a rod which slides vertically in suitable bearings in the drawhead. When two cars meet, the hook engages with a catch block, which is also fixed on a vertically sliding rod in the opposite drawhead. The upper ends of the said rods project above the drawheads and are provided with enlarged heads which are so constructed that they tend to hold the hook and catch block in proper position, lengthwise with the drawhead.

IMPROVED DOUBLE ACTING ANTI-FREEZING FORCE PUMP.

Henry M. Wyeth, Richmond, Ind.—This invention is intended chiefly to provide a submerged double acting porcelain lined pump, which shall be of a simpler construction and less expensive manufacture than those heretofore made. It is an improvement upon that form of pump in which two inlet valves are employed in connection with a single outlet valve arranged in a side pipe which opens into both ends of the cylinder. The invention consists mainly in casting the pump and the side pipe in a single piece, which secures the desideratum of cheapness, and with the greater portion of the said pipe offset or removed from the periphery of the cylinder so as to leave a space between, which permits the successful lining of the pump with porcelain.

IMPROVED COMBINED CENTER AND CARRIER FOR LATHES.

Charles A. Niebell, Scranton, Pa., assignor to himself and P. Franz, of same place.—This device is so constructed as to enable the workman to get the correct center of a shaft without its being necessary to remove the work from the lathe more than once. It may be adjusted to correspond with a long or a short center. It also may be used for gas pipe centers, on shafts for cutting off the riser, for facing pipes, and as a chuck upon any kind of a lathe.

IMPROVED NUT LOCK.

Joseph C. Wright, Philadelphia, Pa.—The object of this invention is to construct a nut in such manner that it may be rigidly held on its bolt, when set in position, by inserting a packing of soft metal or other material capable of expansion, into a recess cut, punched, or swaged in the face of the nut in such manner that the packing may have a direct bearing on the thread of the bolt.

IMPROVED HOSE COUPLING.

William B. Kilbourne, Auburn, Me.—This hose coupling may be readily united. It is not liable to clog so as to prevent it from being quickly put together, and the threads cannot be crossed. The lugs of one part are placed in the recesses in the other part, and the parts of the coupling guided by the lugs are brought squarely together. A sleeve is then moved forward and screwed on the threads of the recessed part by means of a spanner placed on the lugs.

IMPROVED PUMPING APPARATUS.

Waldemar F. Plockross, Fagundus, Pa.—This relates to apparatus used in pumping oil or water from deep wells. It consists of a suitably braced right angled lever, which swings on a pivot between stationary posts, and is connected at the end of its horizontal arm with the pump rod, and at the lower end of its vertical arm, by means of rods, with any convenient motive power.

IMPROVED CORNSTALK PRESS.

Edgar P. Davis, James E. Davis, and John Fisk, Crete, Neb.—This is an improved machine for pressing cornstalks, weeds, hay, brush, etc., into small bundles for fuel. It presses the material compactly, holds it securely until bound, and is so made that one person can be sawing the bundles into lengths while another is passing the bands around them.

IMPROVED PUMP.

Michael Cook, West Le Roy Mich.—The object of this invention is to provide an improved means for giving motion to the piston; also for counterbalancing the same, and for readily removing the lower valve of the pump without removing the pump from the well. An advantage gained by the peculiar construction of this pump is, that the displacement of water by the enlarged piston rod reduces the weight of the water resting on the piston.

IMPROVED STEERING PROPELLER.

Clemens Uller and Jasper N. Bennett, Columbus, O.—The object here is to provide, as an auxiliary device for vessels already built, or to be built, an improved propelling and steering apparatus, by which the vessel may be propelled to the right or left, forward or backward, without stopping the engine. The invention consists of a vertical revolving shaft, with horizontal paddles that are submerged in the water and turned alternately into horizontal position by a cam of a sleeve around shaft, said sleeve being adjusted by a steering lever, in connection with a disk and ratchet device.

IMPROVED FOLDING BOAT.

John H. Bates, Nanticoke, Pa.—This consists in the arrangement in a boat of a folding bottom, folding ribs, and flexible sides, and a removable rail, seat, and oar lock. A covering of canvas, or other flexible waterproof material, is attached to the boat bottom by means of nails, and is secured to the rails at the top of the boat by straps which are engaged by buttons that project from the rails and from the posts at the bow and stern. The boat thus constructed is light and strong, and is capable of being quickly taken apart or put together, and when taken apart it may be folded together and packed in small compass.

IMPROVED STEAM ROAD WAGON.

George W. Wade, Clam Lake, Mich.—The track wheels are made large and with wide flanges upon the inner sides of their rims, to serve as tracks for the small driving wheels to run upon, so that the machine may lay its own track as it advances. A power is applied to the axle, the driving wheels roll forward upon the flanges of the track wheels, and are all the time rolling up a slight inclined plane. Should the track wheels, or either of them, strike an obstruction, they will stop, while the driving wheels will roll up a steeper inclined plane until the center of gravity has passed the point of resistance, when the track wheels will gently tilt over the obstruction, and the wagon will pass on without jar.

IMPROVED COMBINED NOZZLE AND SPRINKLER.

Neil Malmquist, Brooklyn, N. Y., assignor to himself and John Loyd, New York city.—This invention consists in a sprinkler provided with a short tube in its face directly opposite its screw socket, and having its outer end covered with a perforated cap, with a tube in its side, having the outer end closed. A small marble is placed within to adapt the device for throwing water in a solid stream or a shower.

NEW AGRICULTURAL INVENTIONS.

IMPROVED PLOW.

James F. Wilson and Richard I. Wilson, Calhoun, Ga.—The wings of this plow are so constructed that they may be raised out of, and lowered into, working position separately or both together, as may be desired. They also may be adjusted to prevent small plants from being covered or injured by having soil thrown upon them.

IMPROVED CORN PLANTER.

Robert Fox, Deerfield, Iowa.—This relates to improvements in corn planters; and it consists in an arrangement of plows on an adjustable shaft, by turning which the plows are raised or lowered.

IMPROVED PLOW.

Charles Atkinson, Monterey, Ill.—This is an improved plow for opening trenches and subsoiling. It is so constructed as to clear itself in opening trenches, and may be readily adjusted to work at any desired depth in the ground.

IMPROVED DITCHING MACHINE.

James R. Slaton and John M. Wadlington, Morganfield, Ky.—This is an improved machine for opening ditches of any desired depth and width. It may also be used with advantage for grading roads, and for various other purposes where soil is to be moved. The scraper may be raised or lowered by the advance of the machine, according as a lever is operated. Devices are provided to lock the scraper in place and hold it down to its work in operating upon hard soil. There is an upper carrier designed for use in opening deep ditches to prevent the soil, and especially clods and lumps, from sliding or rolling back. As the soil reaches the upper end of the carrier it passes into an inclined spout, by which it is conducted to the side of the ditch. The spout may be inclined in either direction to deposit the soil upon either side of the ditch, as may be desired.

IMPROVED CHURN DASHER.

John L. Maxwell, Bentonville, Ark.—By suitable construction, as the dasher is raised, the tendency is to form a vacuum beneath it. This opens the valve and draws air into the cavity of the handle and the cavity of the dasher. As the dasher is forced downward the valve is closed, and the air is forced into and through the milk. This introduction of air, and the peculiar form of the dasher, throws the milk into violent agitation and brings the butter quickly.

IMPROVED DITCHER.

Wilbur R. Peet, Viola, Iowa.—With the bottom cutter is connected a rest, supported on any suitable bar, so as to allow the furrow slice to begin to turn only at some distance from the knives, and thus prevent any strain that might arise from tearing the slice. A turning board is arranged, cut and fitting diagonally across the face of the rest, and rising on a gradual lateral slant to and above the bars, so that when the furrow slice rises above the bars it will be thrown over and reversed from its natural position, and not merely turned on end. The turning board is provided with water channels to allow the moisture to drip back into the furrow.

IMPROVED SWINGING GATE.

William A. Ohaver, Monmouth, Ill.—To the shorter end section of the gate is attached a balancing block, which facilitates the swinging of the gate into open or closed position, but which does not entirely balance the longer section, so that the latter is slightly heavier than the block and shorter section, for bearing, by its outer and lower end, either on a notched block when closed, or on the ground when opened, for being retained in either position without propping or holding.

IMPROVED PLOW.

William Clore, Rising Sun, Ind.—This invention consists in so constructing and connecting the share, land side, and colter of a plow, that a close and firm joint will be formed, and the parts always maintained in exactly their true relation to each other.

IMPROVED PLOW.

John M. Looker, Abilene, Kan.—This plow may be readily adjusted for the different kinds of plowing, and to take and leave land. The invention consists in a plow provided with an arrow-head point having its landside wing projecting beyond the line of the landside of said plow; and in the share formed solid with the arrow-head point, made nearly flat, and having the outer part of its forward edge curved forward.

IMPROVED FARM GATE.

Orlando F. Fuller, Lamont, Mich.—This is an improved farm gate that may be conveniently adjusted at suitable distance above the ground, to clear the snow in winter, and admit the passage of smaller animals. It is also self-closing by its own weight as soon as released.

IMPROVED HOP DRYER.

Charles A. Sands, Burlington, Kan.—This invention consists of a hop drying apparatus, consisting of a centrally pivoted box that takes the place of the drying floor. The box has a top and bottom of wire gauze, and hinged end doors that connect with openings in the walls of the upper and lower stories, for charging and discharging the hops to and from the dryer. The end doors of the drying box are provided with transverse rubber cushions or strips for closing the space between the walls and the box when said doors are in a horizontal position, and thereby compelling the heat to pass through the drying box.

IMPROVED HAY RAKER AND LOADER.

John S. Hewitt, Wheatland, Mo.—This is a machine that may be attached to the side of a wagon, which will gather the hay from the ground and deliver it to the hay rack carried by the wagon. As the wagon is drawn forward the machine is set in operation by the rotation of a wheel. The forward motion of the machine gathers the hay on the teeth of the rake. An endless apron elevates the hay and delivers it to another apron, which carries it laterally to the rack of the wagon.

IMPROVED SELF-RAKE FOR HARVESTERS.

Isaac N. Cherry and Robert N. Cherry, Jersey city, N. J.—The object here is to provide a rake for harvesters that will deliver the gavels at the rear of the machine in compact form for binding. The reciprocating motion of the ratchet bars, the teeth of which move the grain along the platform, is continuous, and when a sufficient quantity of grain is carried into the fingers of the delivering apparatus, they first close down on the gavel and then are drawn backward. When the gavel is drawn from the platform the fingers fold down and allow it to pass, but afterward spring up and prevent the escape of loose grain. The entire mechanism is exceedingly ingenious.

NEW HOUSEHOLD INVENTIONS.

IMPROVED NIGHT LAMP.

Harry W. Huntington, Williamsburgh, N. Y.—This lamp is provided with a very small wick tube, and is intended for burning through the night; and by the arrangement of the wick tube the flame is located at a distance above the oil, so that the oil is not heated and gas is not generated, and, consequently, danger is avoided. By the use of a chimney of suitable length smoking is avoided without using many of the devices common to larger and more complicated burners.

IMPROVED SPITTOON.

Pierre Célestin Ste. Marie, Montreal, Canada.—This spittoon is composed of two parts, so constructed and fitted together that when the spittoon is overturned its contents are received by the upper part thereof, thereby preventing soiling of the floor or carpet. The spittoon is supported upon casters, whose stems or pivots are fitted in sockets formed in ornamented bases or enlargements of the base rim of the spittoon.

IMPROVED COMBINED DESK, WASHSTAND, AND BLACKING CASE.

Alexander O. Kirkwood, Yonkers, N. Y.—This consists in the combination, in a single piece of furniture, of a desk having a convenient receptacle for books and papers, a washstand having a convenient reservoir for water, a stationary bowl, an adjustable mirror, and a closet for towels, etc., and also a towel rack and a blacking case, which contains a folding rest for the foot and a place for the blacking and brush.

IMPROVED SPRING BED BOTTOM.

John H. Palmer, Warren, Pa.—This spring bed bottom is so constructed that the springs may be conveniently adjusted according to the weight they may have to support, that the rails may be braced against the pull of the springs, and that the springs may be kept in proper position when under pressure. In it, plates are provided with single or double notched flanges, and made in two parts, with their adjacent ends inclined to cause them to meet at an angle, in combination with the frame and springs of a bed bottom and couplings, formed of two short rods, are rigidly connected by an arm, in combination with the springs.

IMPROVED STOVE MAT.

Christian A. Reimers and John C. Branch, Davenport, Iowa.—The wooden body of the mat is covered with a zinc sheet which is spun over its circular edge. In order to form a raised rim on the zinc a bead is spun, or otherwise formed, on its upper side, near the edge of the mat, and a rod or stout wire is laid in the groove (on the under side of the zinc) to prevent the bead being indented or flattened by blows or pressure.

IMPROVED VEGETABLE SLICER.

Joseph H. Alfred, Rosbach, Iowa.—This consists of a frame containing a pivoted and grated support on which to place articles to be cut, and in a series of knives arranged tangentially to a circle described from the pivot on which they swing, and which pass between the bars of the support. The whole is supported by a frame, to which are attached receptacles for the articles to be cut, and for the slices cut by the apparatus.

IMPROVED KNIFE AND FORK CLEANER.

Albert E. Van Horn, Sebewaing, Mich.—This consists of an inclined scouring table with side rims, having a till or receptacle at the lower end for the scouring powder. A leather strap is stretched on a fork-shaped support for facilitating the cleaning of the forks.

IMPROVED DOOR CHECK.

James B. Everest, Yonkers, N. Y.—This consists in a spring of peculiar shape made from a single piece of spring wire; the object being to provide an inexpensive and simple device that may be readily placed under doors of every description for holding them in any desired position.

IMPROVED TABLE EASEL.

Christine Fisher, Salisbury, N. C.—This easel is adapted to the use of architects, civil engineers, and others, and is so constructed that it may be adjusted to have a level top, or to give its top any desired inclination, and to enable paper of any desired length to be used, holding the part being worked upon smoothly and firmly.

IMPROVED BUTTER AND FRUIT JAR.

Charles A. Sands, Burlington, Kan.—This improvement consists of a butter and fruit jar having a bevelled lid seated by an interposed rubber gasket on the tapering top edge of the jar, and being secured by a rubber band lapping over the lid and the recessed edge. The bottom edge of the jar has also a circumferential recess with a rubber band extending into the recessed part and lapping over the bottom edge, to produce, in connection with the top band, protecting cushions.

IMPROVED ARM REST.

Philo R. Wago, Rockport, Mo.—This is a novel device to be attached to a desk or table for supporting the arm while writing; and it can be adjusted to the required height to suit books of different thickness. In working on large sheets of paper or maps covering the whole desk, it is used to widen the desk, thus making it convenient to write on the extreme lower edge of the sheet. It also can be used with equal advantage in any position which the writer may assume.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED AWL.

George P. Harley, Allendale, S. C.—By this invention leather may be stitched together with rapidity and facility. It has a recess and hook back of the point, and tapering side channels running from the recess to the point.

IMPROVED CARD HOLDER.

Henry J. Herbert, London, England, and Edward R. Wilbur, New York city.—This is an improved device for holding business cards, adapted to be hung upon a wall, and so constructed as to display a card. The chief feature of the invention is a hinged card receptacle, and a case therefor. The rear side of the receptacle is provided with a weight or spring, to draw it closed when released, after having been opened.

IMPROVED WHIP.

George P. Overin, New York city.—The core is formed of one or more strings of gut, and is stiffened and filled out by rattan sections. Hitherto, the rattan sections have not been used with the enameled surface, as the pith only has been employed; but, by this method, the natural strength and elasticity of the outer or enameled surface are retained and utilized.

IMPROVED COPY BOOK.

John W. Manning, Cambria, N. Y.—This consists in an arrangement of movable copies, and in an improved method of fastening the same in the book, which facilitates the operation, so that the copy books may be readily made. The copy slips are of the same length as two of the pages of the book, and are folded in the center and placed on the threads and wire. The copy is moved down the page, so as to cover each line as it is written, so that the scholar imitates the copy and cannot follow the line he has previously written.

IMPROVED FILTER RACK.

Byron Fenner, Westfield, N. Y.—This consists of a filter rack made of a spirally coiled wire, attached by top hook and jointed center link with lower hook to the top and bottom of funnel.

IMPROVED FRUIT DRYER.

Samuel Myers, Adamsborough, Ind.—This consists in novel means employed to pass a current of dry heated air over fruit until it is completely dried, without allowing the air to stand, or that which has been moistened by contact with fruit on lower shelves to come afterward in contact with that on the upper shelves.

IMPROVED HARNESS SADDLETREE.

James McCormick, Glidden, Iowa.—This invention consists in a saddletree made in two parts having lugs formed upon their upper ends, halved to each other, and provided with teeth to mesh into teeth formed upon the under side of the base of the water hook. The lugs are perforated to receive the screw by which the said parts are firmly locked together. Upon the rear end of the screw is formed a loop to receive the back strap, and which also serves as a handle for screwing the said screw in and out. The tree may thus be adjusted to fit the horse's back.

IMPROVED MANUFACTURE OF SPECTACLE TEMPLES AND JOINTS.

Dormer C. Winans, New Haven, Conn.—According to the method heretofore practised, the temples and joint pieces of spectacles have been constructed from separate pieces of metal, and soldered together. The object of the patentee is to cheapen and improve the construction of temples and joint pieces by forming them solid together, or in one piece. For details, see patent.

IMPROVED TALKING AND CRYING DOLL.

William A. Harwood, Brooklyn, N. Y.—The object of this invention is to provide a sound-producing attachment to be applied to the bodies of dolls, which may be blown by the mouth to imitate vocal sounds.

IMPROVED ICE BOX ATTACHMENT FOR COOLING ALE, ETC.

James J. Moloney and Isaac S. Schuyler, Brooklyn, N. Y.—This is an ice box provided with a cooling chamber below the ice chamber, and at one side of the latter with keg compartments. A track with movable hoisting apparatus is arranged above. There is a detachable extension of the tracks upon the outside of the ice box to receive a truck and cask, and a combination of crank shaft and rope for moving the trucks upon the tracks.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Notes & Queries

J. B. will find directions for making an æolian harp on p. 315, vol. 33.—J. M. McG., Jr., should read Paddlefast's articles in the SCIENTIFIC AMERICAN SUPPLEMENT.—S. B. W. should read our article on p. 33, vol. 33, on the horse power of an engine.—C. S. S. can calculate the proportions of gear wheels by following the directions on p. 107, vol. 34.—C. D. L. will find on p. 26, vol. 33, an excellent recipe for paint for outdoor work.—C. A. S. should vulcanize his iron castings. See p. 315, vol. 33. This also answers S. T. B.—A. S. C. will find directions for fastening leather or rubber to metal on p. 101, vol. 34.—H. W. S. will find directions for making printers' rollers on p. 283, vol. 31.—C. S. M. will find directions for raising mushrooms on p. 129, vol. 34.—R. B. L. will find on p. 360, vol. 34, directions for renovating clothing.—A. T. N. is informed that the galvanic action set up by putting zinc into an iron boiler is supposed to prevent the formation of scale.—J. W. G. & Co. will find tables of the specific gravity of water in Box's "Practical Treatise on Heat."—B. B. will find something on the passage of water through pipes on p. 48, vol. 29.—I. P. I. will find directions for making wood incombustible on p. 108, vol. 34.—J. J. will find a good recipe for liquid blacking on p. 73, vol. 26.

(1) A. B. R. and many others: The Spitz dog is very closely related to the white or arctic wolf, and has much of the same habit and temperament. Dr. Hammond thinks that the Spitz is a cross between the Pomeranian hound and the arctic fox, and that it is probable that the saliva of the animal is nearly always poisonous in our climate, and particularly so when the dog is at all irritated or excited. It is safe to say that the Spitz dog has never been completely domesticated, no matter how many years have been spent in his education. Nature has fitted him with a very warm and thick coat of fur, which allows him to be acclimated only in the arctic regions, whence he has evidently been brought, an unwilling captive. In appearance, the dog, at maturity, generally averages 26 inches from the tip of his sharply pointed snout to his tail, which is quite bushy, and in general curls up over his back. He stands about 12 or 15 inches high. His head much resembles the fox in shape; the ears are small, and the entire body is thickly covered with beautifully white, stiff hair, that stands more or less straight out from the body. This hair is very long—in some cases as much as three inches—especially around the head, throat, and flanks, and gives the dog the appearance of having a much larger body than is really the case.

(2) C. S. V. says: A friend argues that a cow can at will hold up her milk, that she can purposely hold it to go dry. Can this be true? A. The secretion of milk by the cow is wholly involuntary. But it is within her power to prevent the flow of milk from the udder under ordinary circumstances. It is best that the animal be relieved of her milk whenever the udder becomes fully distended.

(3) E. T. V. asks: What is the law as to the examination of druggists' clerks in New York city? A. All pharmacists must present satisfactory credentials or certificates of competency and qualifications to the Board of Pharmacy, when, on payment of a fee of two dollars, and enrolling their names and places of business upon the register, they are entitled to a certificate from the Board. In order to register, the person must be a graduate in pharmacy, a licentiate in pharmacy, or a graduate having a diploma from some legally constituted medical college or society. Graduates, in the meaning of the law, are those persons who have had at least four years' experience in stores where prescriptions of medical practitioners have been compounded, and who have a diploma from any college of pharmacy within the United States, or from some authorized foreign institution or Examining Board. Licentiates are those who have had at least four years' experience in stores, etc., and who shall have passed an examination before the Examining Board or Board of Pharmacy. Applicants for examination must pay a fee of five dollars to the Board, and pass examination before receiving a certificate. Persons failing to comply with the law are subject to a heavy fine.

(4) H. W. S. says: We use wood baskets for throwing charcoal on forge fires, and they are thus exposed to the fire, and are charred and burned. What cheap preparation can we use as a coating to protect them? A. Use a strong solution of tungstate of soda in hot water, or one of waterglass. The tungstate costs about 25 cents per lb. The fireproof asbestos paint is, we believe, a waterglass mixture of the asbestos powder. See our advertising columns.

(5) T. McC. asks: 1. Is it possible to mix benzine and water? A. No. 2. Is it possible to mix linseed oil and water? A. No; but the oil may be saponified by heating with an alkali, and the soap so formed dissolved in water. 3. Is there anything that will dissolve glue without heat or water? A. Try strong acetic acid. 4. Is there anything that, if put on rosin, will destroy it? A roof that is newly tinned has streaks of rosin on the joints, and I want to get it off without damaging the paint. A. We do not know of anything of the kind. Rosin is quite soluble in turpentine, benzine, naphtha, etc. 5. What is the quickest dryer for distemper color? A. See answer to C. D. R., p. 300, vol. 36.

(6) C. H. W. asks: What is there about concentrated lye to cause an explosion? A short time since a lady near Crawfordsville, Ind., was making soap and was using concentrated lye; she had put a box of lye in a kettle, and when she thought it was boiled out, she took it in her hands, and it exploded (there being a small quantity left in the can), injuring her hand very much. She has since taken lockjaw from the injury. A. We are at a loss to explain this strange occurrence. You evidently have not given us all the facts in the matter. You should have stated what kind of a box contained the lye, and what else was in the boiler at the time. Ordinarily there is nothing in potash or soda lye that can directly cause an explosion such as you describe.

(7) C., in speaking of an article published in our issue of March 24 on "Light and the Distances of the Stars," says: I question a problem that finds the distance of stars by the light which comes from them at a rate of 185,000 miles per second without knowing how long the light has been traveling. A. We reply by saying there are no such problems, the distances of but very few of the stars have been or ever can be measured; these are measured by accurately observing their position with regard to other stars; and then, six months after, when the earth has made one half of a revolution around the sun, or, in other words, has moved 185,000,000 of miles to the right or left of its former position, observations are again taken. And if there is no apparent change in the position, then we have no means of determining their distance; but if there should be a slight change of position, the same as there is when a person moves his head while looking at objects at different distances from him, then, knowing the distance we have moved and the amount of displacement produced, we may compute the relative distances of the objects. With those which have no apparent displacement, their distance is only a matter of reasoning: Take a group of stars like the *Pleiades;* if they are not at a very great distance from us, then they are quite near to each other; and as they have no motion to prevent, they would be drawn together by their mutual attraction. Therefore we reason that they are immense distances away from us and from each other, and the apparently small motions which they have are velocities which we have no conception of. But whether it takes light thirty years or thirty thousand to reach us makes very little difference, as the distance of either is incomprehensible. Some persons have asserted that the immensity of space must be filled with stars, or else the outside ones would be attracted toward the center, and thus fall together. But this is not so, for a group of stars may have an orbital motion in which the centripetal and centrifugal forces are balanced, in which case it requires no outside attraction to keep them in position.

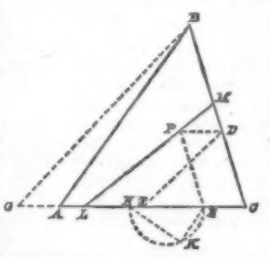
(8) S. B. G. asks: Why is it stated in textbooks that a degree is longer at the pole than at the equator of the earth? A. It is because the length of the degree on the earth is not measured from its center, any more than a degree on an ellipse is measured from its center of gravity. It is measured from the center of a circle of which the curve between the points measured is a part; therefore a degree at the equator is measured on a circle of shorter radius than at the pole. The length of the degree being proportional to the radius of the circle on which it is measured, it will be longest at the pole.

(9) T. H. L. asks: 1. Why is it that some people, who seem to be quite strong in other respects, find it so difficult to climb hills, while others, whose physical development seems to be no better, walk up them without any apparent difficulty? A. The only assignable cause is an existing difference in the physical powers—strength of muscle and lung capacity—in comparison with the total weight. The difference between many people in this respect is often a radical one. 2. What is the best means that may be used to overcome the difficulty? A. Physical culture in general is the only thing to be observed. Work in the open air and partake in moderation of nutritive food.

(10) J. O. M. asks: How is the copper plating deposited on iron? A. It is usually applied by dipping the chemically cleaned iron in a hot bath of solution of sulphate of copper.

(11) D. C. H. says: Some months ago there appeared in a journal of *materia medica* an article describing a new kind of pottery which was said to stand wonderful fire tests. Can such an article be used in restoring sulphuric acid after the oil refiners have used it? A. There is no ware of this kind that we know of that would prove of much service for your purpose. See p. 268 (No. 17), vol. 1, of SCIENTIFIC AMERICAN SUPPLEMENT.

(12) W. E. B. says, in reply to W. H. B.'s query as to bisecting a triangle by a line passing through a given point: The following solution is from Gillespie's "Land Surveying." Let A B C be the given triangle, and P be the given point. From P draw P D parallel to A C and P E parallel to B C. Bisect A C in F, and join F D. From B draw B G parallel to F D, and bisect G C in H. On H E describe a semicircle. On it set off E K = E C. Join K H and set off H L = K H. Then L M, drawn from L through P, will be the required line bisecting the triangle.



(13) A. C. says, in reply to C. A. C., in regard to circumferential velocity of disk to cut cold iron: We find the best speed to be that which gives a circumferential velocity of about 24,000 feet per minute, using a steel disk 42 inches in diameter, and from ¼ inch to ⅛ inch in thickness.

(14) W. A. M. asks: What is boro-silicate of soda? A. It is a glass or enamel made with borax (biborate of soda), soda and silicic acid (sand).

(15) E. W. asks: How can I make a cement or wax, suitable for sealing glass bottles containing a liquid? A. Fused paraffin is often employed for the purpose, also sealing wax. Sealing wax may be made according to the following recipes: Fine red, No. 1: Shellac (bleached), 4 ozs., cautiously melted in a bright copper pan over a clean charcoal fire. When fused add 1¼ ozs. Venice turpentine, and 3 ozs. vermilion. No. 2: Shellac 3 lbs., Venice turpentine 19 ozs., finest cinnabar 2 lbs.; mix, and fuse as before. No. 3.—Same as last, but use half the amount of vermilion. Common red: Resin 4 lbs., shellac 2 lbs., Venice turpentine and red lead, each, 1½ lbs. Bottle wax, No. 1.—Black resin 6¾ lbs., beeswax 2 ozs., finely powdered ivory black 1 lb. No. 2.—As last, but substitute Venetian red or red lead for ivory black. Fine black, No. 1.—Shellac 60 parts; very fine ivory black in impalpable powder, 30 parts, Venice turpentine 2 parts. No. 2: Resin 6 parts, shellac and Venice turpentine, each 2 parts. Soft red: Beeswax 8 parts, olive oil 5 parts, Venice turpentine 15 parts, and red lead to color. Green: As last, but substitute powdered verdigris for red lead. The addition of a little camphor makes the wax burn better. The bottles should be dry, and, if possible, warm.

(16) J. S. B. and others, who ask about postage stamp mucilage: The government mucilage, used for postage stamps and envelopes, is said to be made as follows: Gum dextrin 2 parts, acetic acid 1 part, water 5 parts. Dissolve in a hot water bath, and add 1 part alcohol.

(17) H. G. says: I am running a horizontal engine of 4 inch cylinder and 6 inch stroke, with an upright tubular boiler, the outside measure of which is 30 inches by 6 feet; and I experience considerable difficulty in keeping up steam, and am in doubt as to whether the trouble lies in the engine, which is a pretty old one and loses steam somewhat, or whether the boiler is too small. What is the nominal horse power of the engine and of the boiler? A. You might settle the question definitely by measuring the water evaporated by the boiler, and using a brake at the same time to determine the power exerted by the engine. Any guess we could give from the data sent would be of very little value.

(18) R. G. G. asks: Will you please inform me how a compass is carried on an ironclad vessel, so that the iron will not have any effect on it? A. It is either put up so high as to be out of the influence of the iron, or the effect is counteracted by magnets.

(19) J. H. M. says: 1. I have a 1½ horse power steam engine, and an upright boiler 22 inches high and 16 inches in diameter. The boiler has twenty 1½ inch tubes. Cylinder is 3x4 inches, pipe from boiler to cylinder is ½, and exhaust pipe ¾ inch. Engine when started frequently throws water up the exhaust pipe; and when at work it will often throw up a stream of water, which, unless shut off, puts out the fire. Sometimes it will run all day without throwing water. What are the cause and the remedy? A. You do not send sufficient particulars to enable us to form a decided opinion. From your statement, it seems probable that the circulation in the boiler is not very good, and that the water level is not maintained constant. If this is a correct view of the case, you may derive some advantage by introducing a dry pipe, such as is used on locomotives. 2. The pump on the engine also troubles me occasionally, unless I loosen the cap of the first supply valve and let in a little air to start the suction, it will not pump. With a little air, it works all right, but causes a leak of water. A. It may be that the connections are too small for the speed at which it is run.

(20) B. S. asks: What are the advantages of cars running on trucks with 4 or 6 wheels *vis à vis* to the cars of two axles, with 4 wheels only? A. Every one does not think that trucks are an advantage, as you doubtless know; but their advocates consider that larger cars can be used, that will run more steadily, and go around sharper curves. You will find a good discussion of the subject in the "Catechism of the Locomotive."

(21) W. D. D. says: I have a tank which holds 800 barrels of water, and one 3 inch pipe from bottom of tank 300 feet long, to fill a street sprinkling wagon tank. The water does not half fill the 3 inch pipe. What is the cause? A. It is quite likely that the pipe has high points in which the air collects, and thus reduces the effective area.

(22) G. W. B. asks: If a gallon bucket be placed 20 feet under water, the top of the bucket being closed and a ½ inch pipe placed in the top and reaching up through the water through which the air may pass out, the bottom of the bucket being open, how long will it take for the bucket to fill with water? How long will it take for each distance under water for a ¾ inch pipe? A. The difference of time in the several cases would vary as the square roots of the depths. There would be no appreciable difference with the two pipes.

(23) T. H. says: In your reply to W. L.'s query as to why a gun barrel scatters the shot, you said: Generally it is due to the fact that the barrel is not true or is foul, or to the shape of the breech. I have got a rifle and it is an easy matter to hit a nail head in a fence 20 feet off with a bullet: but I cannot hit a cap book cover with 20 shot, as they scatter from 4 to 5 feet from the mark? A. You are confounding two distinct articles.

(24) E. H. says: A. claims that, when a steam fire engine goes to work from a cistern she is pumping water, and, when the same engine goes to a plug and receives all the water she wants, that she is only discharging what she receives in her pumps or wells. B. claims that a steam fire engine is pumping water, no matter how or by what means she gets it. A. There seems to be some confusion of terms in these questions, but we answer according to our understanding of them, that the pump when at the well both draws and forces water, while at the hydrant it only forces.

Why are the front wheels of a wagon so much smaller than the hind ones? A. Principally to enable it to turn readily.

(25) L. F. C. asks: Why does the light coming to us from fixed stars appear to twinkle? A. Because of the sudden changes in the refractive powers of different strata of the atmosphere, which are not sensible in the case of stars that have perceptible disks.

(26) J. H. S. says: 1. I have an engine of 16 inches bore and 36 inches stroke. I am driving the same at 75 revolutions, with steam 10 lbs. to the inch, cut-off at half stroke. The engine is doing all that it is safe to drive with it, by shaft 8 inches in diameter. Belt is so large that it will hold the engine still at any part of the stroke. I wish to drive two engines, each as powerful as the one I now have; and I propose to add one of the same size on the other end of the shaft. The experts here say that I must make the shaft as large again as it is, and the belt also. I say that both belt and shaft are as large as is required, as they have beaten the full power of the one engine. A. It is possible that you are right; but you cannot know without making an experiment. At most, however, the size of the shaft will not have to be greatly increased. 2. How long is the expanding steam useful after being cut off? Condensation has nothing to do with this; I take the ground that there is useful effect in steam until it is down to the pressure of the atmosphere, assuming in this case that there is no condensation. My opponents say that if the engine takes 10 lbs. of steam to turn it over the center, that the expansion is of no use after the pressure has fallen below 10 lbs. I say that there is useful effect in steam as long as it is above the atmosphere, and so long will it give out useful effect on the piston. A. You have the right idea, but somewhat too extended. If there is any back pressure, that is the limit of the expansion. 3. Is there any advantage in the engine valves like Corliss' over ordinary valves? Take the common slide valve with a cut-off on the back of the main valve, the top valve to be worked by the governor so as to cut off the steam at any part of the stroke. Is this advantageous, and which is the best of the two systems? A. The valve that closes most quickly, and is the most nearly balanced, will give the best results, other things being equal.

(27) H. T. says: I see in your SUPPLEMENT an article on compressed air, stating that there is at least 50 per cent lost. How does this loss occur? If I force 10 cubic feet air into 1 cubic foot space, would it exert a force of 150 lbs. to the square inch, and would it not give back all the power that it cost to compress it, less the friction for packing, etc.? A. The statement to which you refer gives the reason. The air, instead of being allowed to expand and give back the power required to compress it, is supposed to be admitted for the whole of the stroke.

(28) J. H. G. says: 1. I am building an engine 4¼ x 4½ inches, and wish to put it into a boat, with fine lines, 30 feet long, of 7 feet beam and 30 inches draught. Please give me the probable speed obtainable, the engine using steam at 100 lbs. pressure for ¾ of the stroke and making 500 revolutions per minute? A. Probable speed from 9 to 10 miles an hour. 2. What should be the heating surface of boiler and diameter and pitch of the screw? A. Heating surface of boiler, 150 square feet. Propeller, as large as can be submerged, of 3 feet pitch.

(29) M. T. S. says: I am making a machine of cast iron for cutting fruits and vegetables. What paint or varnish should I put on it to keep it from rusting? A. Paints or varnishes will not answer for this purpose. It is best to have the iron nickel or silver plated. See p. 222, vol. 36. "Prevention of Rust on Iron."

(30) G. C. Q. asks: 1. What volume of water in the state of vapor can be absorbed by a given volume of sulphuric acid before the acid becomes completely saturated? A. Strong oil of vitriol will absorb more than twice its volume of water vapor; but as the dilution proceeds, the absorbing power of the acid decreases proportionately. 2. What is the most simple method by which the acid can be rid of the water it has absorbed, so that it is ready to absorb again? A. The only way is by evaporation with the aid of heat in glass, porcelain, or platinum vessels.

(31) G. E. asks: How can I mix paint that will do for painting steam pipes or the parts of an engine which are heated by steam? If I use water color it rubs off; if oil, it turns dark from the heat? A. If you do not wish to use a dark color, mix your paint to a lighter shade than it is permanently to be, and let the heat deepen to the color till it sets.

(32) J. V. B. says, in reply to D. D., who asks what is the cheapest and best preparation for the preservation of shingles: Use 3 lbs. of green vitriol in water to the 1,000 shingles. This preserves the shingles and renders them to a great extent fireproof. Shingles made from wood of evergreen trees are best.

(33) R. B. R. asks: Is there any instrument in which, as in a reservoir, electricity could be stored up, so as to be used occasionally as need might require to produce motion? If I should employ a windmill to generate electricity by a Gramme machine, could I store up the electricity until it acquired a certain and sufficient tension, and then draw from it as I choose, without the necessity of using plates, porous cells, carbons, etc., and without danger? A. No. A battery composed of Leyden jars may be charged with statical electricity, but the quantity of electricity that can be so stored is limited, and it is difficult to retain the charge for any length of time. Low tension electricity, such as is used on telegraph lines, cannot be stored.

(34) J. F. D. says: Some time ago I made a voltaic pile, which I cannot get to work. I put circular blanks, 4 inches in diameter, thus: Copper, zinc, fabric, copper, zinc, fabric, etc., punched holes in center of them, and piled them up around a stick. Please tell me what is necessary to make it work? A. Remove the stick and moisten the pieces of cloth. The shape of the disks does not in any way influence the strength of current. Make the cloth the same size as the disks with which it is in contact. It will require several hundred of the couples to produce a sensible spark.

(35) A. B. asks: How can get I rid of lice in poultry? A. Make the roosts perfectly clean with hot soap and water, and afterwards apply spirits of turpentine or kerosene oil. Also strew some sprigs and branches over the floor of the coop. The building should be kept clean.

(36) S. R. S. says: Having read that an engine has been disabled by putting a bar of soap in the tank, I wish to know what the action of the soap in the boiler was? Did it cause foaming? A. Yes.

How can I take grease spots out of fine felt cloth without injuring the cloth? A. Moisten the spotted parts thoroughly with pure benzole, and immediately cover them on both sides of the cloth with dry pipeclay or tripoli powder. Then place under a weight for some time, and the spots will disappear.

(37) H. E. L. asks: Is there anything that will remove Indian ink stains from drawing paper? A. There is nothing that we know of, except a good steel eraser or sanded rubber. Indian ink contains finely divided carbon, which is unaffected by any ordinary solvent.

(38) J. A. H. asks: What size of wire and how much in length shall I use for magnets for the electro-magnetic engine described in SCIENTIFIC AMERICAN SUPPLEMENT No. 19, to give the most power with a single Calland cell? If I use 2 cells, how shall I connect them? What is the rule for estimating the resistance of batteries and of magnets and other wire connections, in order to proportion one to the other? Mr. Sawyer says, in describing the engine above referred to: "No. 34 wire is the best size for magnets;" you say, in answer to a subsequent inquiry on the same subject, "use No. 18 wire." Can you explain this? A. With a given battery the greatest magnetic effect is obtained when the resistances of the battery and magnetizing helix are equal. The average resistance of a medium size Calland cell in good condition is about 1·5 ohms, consequently the resistance of the helix should be the same according to the above statement, and this is equivalent to about 330 feet of No. 18 or 90 feet of No. 23 pure copper wire. With a Grove cell, large wire and fewer convolutions would be best.

(39) H., L., & Co. ask: Does the putting of concentrated lye in boilers, to soften the scale, injure the iron? A. The lye will have little effect on the iron, but may cause the water to foam.

(40) C. R. asks: How can the lambskin aprons used by freemasons be cleaned? I used benzine; it frees them of dirt, but makes them look dingy and yellow. A. Have you tried soap and water? It is not probable that the benzine would leave a stain on the wool if used in excess. Bisulphide of carbon is among the best solvents for oil and grease, and will perhaps give better results than the benzine. Try also wood naphtha. If too little of the solvent is used, it will only carry the stain from the surface further into the material. It should be observed that all of these oil solvents tend to destroy the pliability of the leather and necessitate its re-priming or oiling after drying.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

D. M. B.—It is a coarse sand formed by the disintegration of granite. If you look at it with a strong magnifying glass, or low power microscope, you will find it composed of films of mica, orthoclase, and quartz crystals. It contains some iron oxide and pyrites.—N. B. B.—They appear to be all carbonate of lime crystals—calcite. The varieties of calcite are very numerous and diverse in their diaphaneity, crystalline structure, and color, the variation being due to the different modes of origin and impurities.—W. R. L.—It is graphite or plumbago, mixed with clay.—E. D. R.—We have not been able to classify the shells, as they were very much broken and imperfect.—M. M. B.—It is a hematitic iron ore, containing crystals of iron pyrites. See p. 7, vol. 36. It is of little value.—A., Bros.—It is graphite, an allotropic form of carbon, sometimes called plumbago and black lead. It is found associated with sphene, tabular spar in granular limestones, with pyroxene, spinel, chrondrolite, hornblende, scapolite, syenite, and gneiss, and in some iron ores. It is used for lead pencils, in black-lead crucibles, and as a substitute for oil in lubricating machinery; and it constitutes what is known as stove blacking. It is found in many parts of the United States, and is mined at Ticonderoga and Fishkill, N. Y., at Brandon, Vt., and in North Carolina. Its market price is from 3 to 6½ cents per lb.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Flying Machines. By D. J. C.
On Fire Escapes. By J. M. C.
On Interference Colors. By H. M.
On Compressed Air. By F. G. W.
On a Snake-Eating Frog. By C. F. S.
On a Needed Invention. By J. E. E.
On Microscopy. By P. T.
On the Flight of Birds. By J. H. H.
On Cutting Gears. By M. J. S.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells hydraulic rams, and where can circulars descriptive of them be obtained? Who makes steel wire, suitable for spiral springs, to be wound cold? Who sells sal soda and soda ash? Who buys bones, and what are they worth? Who sells machines for setting pins in rubber cloth, for making metallic hair brushes?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

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[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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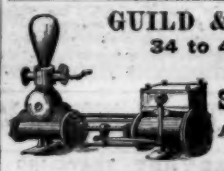

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